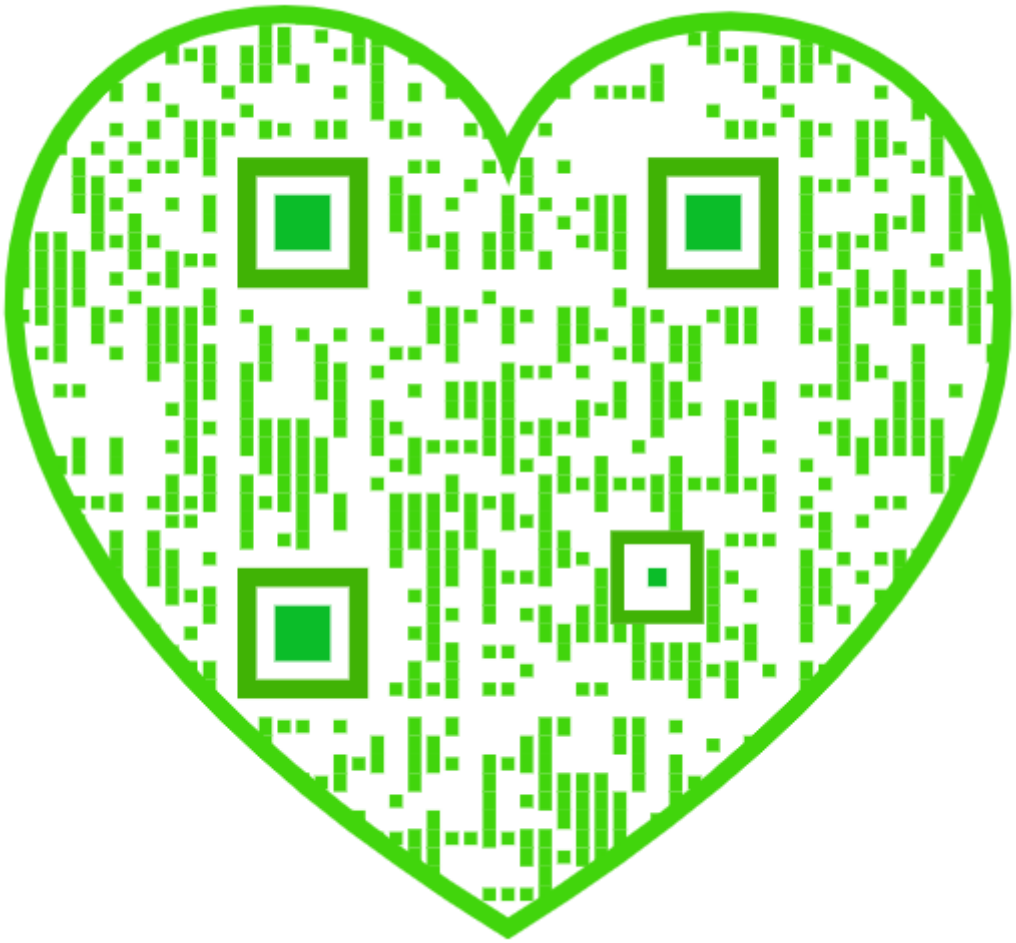
A 000 611 535 6
UC SOUTHERN REGIONAL LIBRARY FACILITY

PRACTICAL COFFEE PLANTING.

BY

F. H. SPROTT.



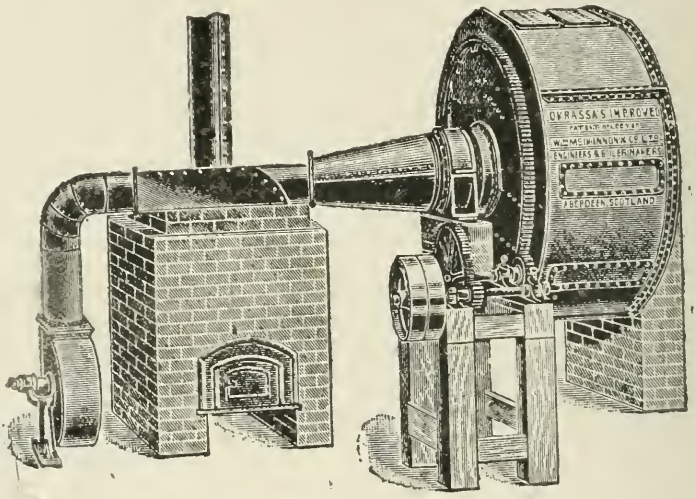
Wm. McKINNON & Co.,

LIMITED.

Spring Garden Iron Works,

ABERDEEN, SCOTLAND.

Coffee Machinery Specialists.



Sole

McKINNON'S

Coffee Dryer, Okrassa's Patent.

Okrassa Patent Coffee Dryer

COMBINED WITH

Okrassa's Patent Direct Fire Heater.

Sole Agents in Kenya.

Durant Radford & Co., Ltd.

Nairobi.

Telegrams & "Shipping"

P.O. Box 270. Telephone 452.

UCSB LIBRARY
X- 31931

PRACTICAL COFFEE PLANTING.

With Special Reference to Eastern Africa.

BY

F. H. SPROTT.

Published by
The Caxton (B.E.A.) Printing & Publishing Co., Ltd.,
NAIROBI.
Kenya Colony.

J. W. MILLIGAN & Co.

IMPORT & EXPORT MERCHANTS.

LAND & ESTATE AGENTS.

Sole Representatives in Kenya Colony

OF

JOHN K GILLIAT & Co., Ltd.

7, Crosby Square,
LONDON, E. C. 3.

Coffee, Sisal, Flax, Etc., Merchants.

We undertake the shipping of COFFEE and other PRODUCE to Messrs. J. K. GILLIAT & Co., Ltd., for sale on consignment, on the London and Continental Markets, on the most favourable terms. Advances are made against consignments of Coffee, etc., to the fullest possible extent consistent with ruling prices.

The personal attention of members of the firm, who possess expert knowledge of the various articles and market, is given to all consignments of produce entrusted to their care.

Particulars of the facilities offered and information relating to markets can be obtained from—

J. W. MILLIGAN & Co.,

NAIROBI HOUSE.

P.O. Box 148. — *NAIROBI.* — Telephone 98.

PREFACE.

When Mr. Sprott first mentioned to me that he proposed writing a text book on Coffee Culture, I welcomed the idea, knowing full well that it would be supplying a long-felt want.

Mr. Sprott's experience of coffee planting in Southern India, and his knowledge of coffee planting in this country, has enabled him to treat the subject in a very able manner.

This book will no doubt be found most helpful and interesting, not only to those who have recently ventured into the mysteries of coffee planting, but to those who are about to embark upon the difficulties which beset the novice.

Whilst disagreeing with the Author in certain particulars, I consider that the work will be of great value to Planters.

A. D. Le Poer Trench,

Senior Coffee Officer,

August 29, 1922. Nairobi.

TYSON BROS.

Limited.

(Produce Department.)

Sole Agents for:—

African & Colonial Co. Ltd.

LONDON

London market news issued weekly write us if you do not — received a copy. —

Coffee, Flax, Sisal, etc.

Advances made against consignments.

Linseed, Castorseed and other oil seeds bought for cash.

Tyson Bros. Ltd.

Whiteaway's Building,

NAIROBI.

P.O. Box 129. *Telegrams:* **Managing** **Telephone 117.**

AUTHOR'S FOREWORD.

In this little book I have endeavoured to supply, that which I have long considered to be a great need of the inexperienced Coffee Planter, viz., a guide that will be of use to him practically, by telling him what to do and at least one good way of doing it.

There is a considerable literature on the subject of Coffee, both in book and pamphlet form, but as a rule the books are too obscured by scientific detail to be of general practical use, while the latter are mainly devoted to a consideration of special branches only.

I have endeavoured to be explicit in the simplest manner possible and I must ask my readers to understand that estimates of tasks, costs of production and working, etc., must of necessity be average figures only and should be used as a general guide, since local conditions may make for considerable variations.

My apprenticeship in Coffee was served with Messrs. Mangles Bros., a well known Private Company in N. Coorg, S. India, and I acknowledge with gratitude the training I received and remember with affection the years I spent in that—to my mind at least—most beautiful country.

Although this book is primarily intended as a guide to Coffee Planting in Kenya, nevertheless I cherish the hope that it may be of interest to Planters in other countries and particularly to some of my old friends.

I am indebted to Mr. A. D. le Poer Trench, the Senior Coffee Officer, and several of the Officials in the Agricultural Department of Kenya for assistance and information especially in regard to the Diseases and Pests of Coffee; to Mrs. R. E. Dent, of Kyambu, Kenya Colony, for the sketches of root-systems and to my Father for much patient advice and assistance during the writing of the book.

F. H. S.

29/7/22.

CLOSEBURN COFFEE FACTORY.

Hulling, Cleaning and Grading.

Put your Coffee in Parchment on Rail, post the consignment note together with the necessary instructions for Cleaning and Grading and leave the rest to be done by this Factory.

Railage to the Coast and Shipping is undertaken for you, in addition to which, if instructions are received at this end arrangements can be made for the Insurance of Coffee from the time it leaves your Shamba to the time it is warehoused in the United Kingdom or elsewhere.

Efficiency combined with experience has resulted in CLOSEBURN COFFEE FACTORY obtaining consistently good prices on the Home Markets and numerous Prizes, Cups and Commendations for Coffee exhibits at the East African Agricultutral Shows.

It has been proved on excellent authority that Coffee Cleaned in Kenya can be as well turned out as Coffee treated in the London Mills.

When advances are desired on consignments of Coffee the necessary documents would be forwarded to the Bankers or Agents concerned.

Roast Ground Coffee supplied in 1 lb. and 20 lb. tins.

CLOSEBURN NURSERIES.

Budded Fruit Trees including Oranges, Naartjes, Lemon and Lime. Also other Fruits including Mango, Avocado Pear, Custard Apple, Guava, Loquat and Pineapple.

Coffee Plants lifted and packed with great care to ensure arrival at their destination in good condition, in any part of the country.

Large variety of Garden Plants, Shrubs and Bulbs.

For Lists of Trees and Plants etc. and terms apply to

H. GRAHAME BELL,

CLOSEBURN.

P.O. NAIROBI.

Contents.

CHAPTER I.

ON THE CHOICE OF AN ESTATE.

Species of Coffee—Effect of Altitude—Necessary Climatic Conditions—Necessary Physical Conditions—Labour Supply—Transport Facilities—Analysis of Soil—Method of Taking Sample of Soil for Analysis—Selection of Land.

CHAPTER II.

ON THE AMOUNT OF CAPITAL REQUIRED.

How much Capital?—The Small Estate—Example of Developing a Small Estate—The Large Estate—Example of Developing a Large Estate.

CHAPTER III.

ON MAKING THE CLEARING.

Cutting the Bush or Forest—Clearing with Squatters—Stumping Jack—Saltpetre and Sulphuric Acid methods—Partial Clearing—Working the Soil—Ploughing and Harrowing—Digging and Beating Out—Draining—Cutting Pegs—Distance of Planting—Lining Out—The Squaring System—Other Systems of Lining out—Table of Number of Trees to an Acre—Roads and Paths—Pitting or Holing—Filling.

CHAPTER IV.

ON SEED AND PLANTING.

Importance—Choice of the Seed—Preparation of the Seed—Choice of Nursery—Seed Beds—Sowing the Seed—Permanent Beds—Planting Framework—Overhead Shade—Transplanting Seedlings—Care of the Nursery—Age for Planting Out—Root Pruning—Rejection of Plants—Ball Planting—Planting Out.

THE

Motor Mart and Exchange,

LIMITED.

Sixth Avenne.

P.O. Box 179. Phone 290.

NAIROBI.

Agents for—

Hupmobile and Chevrolet Cars.

Harley-Davidson Motor Cycles.

Michelin Tyres.

LODGE PLUGS.

Accessories of all Kinds.

CHAPTER V.

ON THE CARE OF YOUNG COFFEE.

Cultivation—Fencing and Trenching—Fire Paths—Windbreaks—Protection Against Cutworm—Catch Crops—Green Dressings—Prevention of Wash—Catch Pits—Contour Trenches—Handling—Disbudding—Capping and Topping.

CHAPTER VI.

ON SHADE.

Description—Qualities of Temporary Shade Trees—Species of Temporary Shade Trees—Qualities of Permanent Shade Trees—Species of Permanent Shade Trees—Plan of Shading—Protection of Plants.

CHAPTER VII.

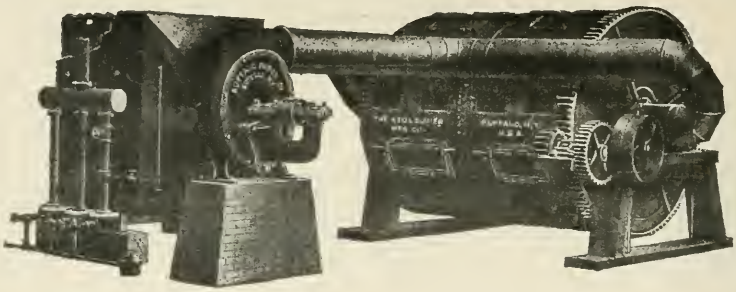
ON THE FUNGOUS DISEASES OF COFFEE.

General Notes—Leaf Disease—Bordeaux Mixture—Experiments with Bordeaux Mixture—Carbide Mixture—Harbas Mixture—Die Back—Brown Eye Spot—Sooty Mould or Black Blight—Stump Rot.

CHAPTER VIII.

ON THE INSECT PESTS OF COFFEE.

General Notes—Thrips—Soap Solution—Nicotine Suphate—The Coffee Bug—The Cut Worm—Leaf Miner Moth—The Stinging Caterpillar—Scale Insects—Borers.



THE WORLD'S

BEST DRYER

IS THE

SQUIER-GUARDIOLA

Supplied with either steam or Direct Fire Heater.

"GUATEMALA" Pulpers.

"GRANADA" Separators.

"NIAGARA" Hullers.

MANUFACTURED BY THE
GEO. L. SQUIER MANUFACTURING Co.

Sole Agents:

G. NORTH & SON, Ltd.

Victoria Street.

Telegrams: "HERCULES." NAIROBI. **P. O. Box 485.**

CHAPTER IX.

ON PERSONAL ADVICE AND BOOKS.

Advice to Young Planters—General Description of a Planter's Work—Estate Books—Forms for Estate Record Books.

CHAPTER X.

ON THE GENERAL WORK OF AN ESTATE.

Estimation of Crop—Weeding and Cultivating—Capping and Pruning Systems—The Single-Stemmed Tree—The Two-Stemmed—The Three-Stemmed—The Four-Stemmed—Agobiada—Lemings—Distance of Trees—Handling and Centreing—Pruning of Shade—Supplying up Misses—Repairs to Fences and Trenches—Cleaning of Fire Paths—Repairs to Roads and Buildings—Renovation of Old Coffee.

CHAPTER XI.

ON THE MANURING OF COFFEE.

Necessity for Manuring—Green Manures—Bulk Manures—Pulp Compost—Application of Bulk Manures—Organic Manures—Chemical Manures—Application of Non-Bulky Manures.

CHAPTER XII.

ON THE PREPARATION OF COFFEE.

Picking—M'buni—Cleaning — Pulping — Fermenting — Washing—Drying—Necessity for a Standard Measure—Peeling or Hulling and Polishing—Grading—Bagging—Estate Marks—Shipment.

CHAPTER XIII.

ON GENERAL SUBJECTS.

Advances on Crop—Commerce and Markets—Co-operation—Labour-Saving Devices—Coffee Legislation, The Pest Act—Figures of Costing and Yield of Coffee—Possibilities and Attractions of Coffee Growing in Kenya.

JOHN GORDON

& Coy's.

Famous

Coffee Machinery.

Stocks of all kinds and Spare Parts carried by:—

British East Africa Corporation, Limited.

Nairobi.

P.O. Box 182.

Kampala.

P.O. Box 12.

Tanga.

P.O. Box 14.

CHAPTER I.

ON THE CHOICE OF AN ESTATE.

The conditions governing the choice of an estate are many and varied, ranging from climate to capital. This chapter is devoted to a consideration of those, on which direction can be given, the other more personal ones being of necessity left to each individual to decide for himself.

SPECIES OF COFFEE.

Tropical Africa shares with Central and South America the honour of being the chief home of coffee. Up to the present time some thirteen different varieties of the wild genus have been named and one or two more are still in doubt. In some of the forests in Kenya wild coffee may be found in large quantities and a study of and experiments with these might possibly yield valuable results.

The varieties cultivated in Kenya are the Mocha, which is much the most extensively used, and the Blue Mountain, which is now being recommended for the higher altitudes.

The former has here and there become hybridised to a limited extent with a Nyassa variety forming a plant somewhat like the Blue Mountain; these plants, however, have been found to be a bad type and should be eradicated.

They may be recognised by the long narrow, bronze or reddish coloured leaves. The habit of the plant is vigorous and fast growing, but the berries produced are large and much misshapen, and it it not as a rule a prolific bearer.

Coffea Robusta is not recommended for Kenya, although a very vigorous grower and very heavy bearer, for the quality of the bean is very low. Two hybrid coffees which have been bred up in S. India with the object of obtaining a vigorous, disease-proof type, yet having good quality, are undergoing trial in Kenya, and are said to be doing well. These are Jackson's & Kent's Hybrids.

The Nyassa variety is also grown in Uganda.

EFFECT OF ALTITUDE.

Coffee trees grown at a low altitude have a rapid habit of growth; the primaries are set wider apart on the stem and the trees cover a greater area. The quality of the bean is lower, though the yield is heavier. In Kenya this may be applied as a rule to altitudes under 6,000 feet, though there are certain districts whose climatic conditions render them exceptions.

Coffee trees grown at an altitude of over 6,000 feet are of what may be called the "Mountain" type. The growth is slower, the primaries closer and shorter and the whole habit of the trees is more bushy. The quality, given equally good conditions of soil, etc., is higher and the yield rather smaller than at the lower altitudes.

NECESSARY CLIMATIC CONDITIONS.

Coffee requires a somewhat temperate climate in the tropics and a fair rainfall. The rainfall of the coffee districts of Kenya varies between 40 inches and 90 inches or so. With a rainfall so low as 40 inches there is the serious danger of droughts, while in very rainy districts it is somewhat difficult for the berries to ripen. The heavier rainfall is to be preferred, however. Coffee must not be exposed to the danger of frost and must be protected if hail storms are experienced in the district. A damp, misty climate is not good.

NECESSARY PHYSICAL CONDITIONS.

Coffee will thrive in a variety of soils from Laterite Clay to Sandy Loam, but, as it is essentially a lateral feeder, the richer the top soil the better. Virgin forest or heavy bush land are the best, having a deep humus formed of decayed and decaying vegetable matter. A heavy growth of vegetation is indicative of a rich top soil. A sub-soil of red or chocolate loam is the most suitable for coffee in Kenya. Coffee does not require a deep soil; 6ft. or 7ft. being ample. A supply of water for pulping etc., within reasonable distance is an absolute necessity, if coffee growing is to be more than a pastime. Neither absolutely flat nor very steep land are the best for coffee in Kenya, the former being difficult to drain, and the latter suffering from wash. Gentle to moderate slopes, not too sheltered will be found the best.

LABOUR SUPPLY.

One of the first and most important points for the planter to ascertain when choosing a district in this country, is the existing and possible labour supply. If all the labour has to be imported on contract from a distance, the costs of production will be greatly increased, for Coffee is a crop that requires much labour, and, if the intending planter has not over much capital, it would be as well to look for a suitable piece of land in a district better supplied with labour.

TRANSPORT FACILITIES.

Good roads and proximity to the railway are also factors to be seriously considered. If coffee has to be sent by wagon over great distances, it runs a risk of deterioration on the way, and it will probably necessitate the sending in parchment, which means added transport.

The intending planter in Kenya, whether with or without experience in other countries, should not be in too great a hurry in the choice of his land. Let him consider thoroughly all the essential conditions for a successful estate in the light of the amount of capital available, and his own personal conditions of age, health, etc. He would be well advised to stay in one district for at least a few weeks and examine thoroughly any land that promises to be suitable.

ANALYSIS OF SOIL.

In the case of any piece of land that takes his fancy, it would be a sound measure to have an analysis of the soil made, which, if he is not an agriculturist himself, he could send to the Agricultural Department for report and advice as to increasing any important elements that may be lacking.

METHOD OF TAKING SAMPLE OF SOIL FOR ANALYSIS.

The method for taking a sample of soil for analysis is as follows:—

Remove actual sticks and leaves, but not leaf mould, from an area of a few square feet. Dig a hole to the depth of say 2 feet and 1ft. —1½ft. wide. Make one side roughly perpendicular and smooth and clear out the bottom. Then with an instrument, such as a spade, cut a slice of say 1 inch—2 inches thick from top to bottom. Collect this earth carefully and place in a small bag. If this bag of earth has to be sent any considerable distance, it would be better to put it into one or two other bags, in order to obviate as far as possible evaporation of moisture. Details of date and approximate quantity of the last rain should be sent with the sample and any other details that may be of assistance to the analyst by accounting for any ordinary constituents being present in abnormal quantity. At the present time it is improbable that any considerable number of analyses could be made, nevertheless it would be advisable for the newcomer to send a sample of soil in the manner detailed above and to have a report made upon it, as to type, texture, amount of humus, etc.

SELECTION OF LAND

Let us suppose that, having duly considered all the above mentioned conditions and that the terms of purchase are reasonable, the planter has made his choice of a property. The next thing for him to decide upon is where to make a start. Two of the deciding factors are, of course, proximity to water and reasonably light clearing, for he will very naturally want to put a piece of land under coffee as soon as possible. A gentle slope having an easterly to north-easterly aspect will be the best, for it is the face most open to the prevailing winds of the country, and these winds—provided that the actual force of them is broken —are of great value in that they purge the estate of diseases and pests. Should there be any doubt as to the depth of soil on such a piece of ground a few pits about 6 feet deep should be dug in different parts of the area and the types of soil noted.

CHAPTER II.

ON THE AMOUNT OF CAPITAL REQUIRED.

How Much Capital?

One of the commonest questions to be asked by the newcomer to any country,—and Kenya is no exception—is, how much capital would be required for so and so? The only answer to this is 'How much capital and income have you got'? Are you married or single; in good or indifferent health? Have you any previous experience? And are you prepared to work hard and live frugally? If you will tell me these things then I can advise you!!

It is quite impossible to lay down hard and fast rules, as so very much depends on the individual. The amount of capital and income available will be the chief determining factor as to the size of the estate and the speed of development.

It is thought that, under these circumstances, the only feasible method of giving guidance is to divide estates into two types viz: the small estate and the large estate, and to give a hypothetical example of development in either case.

THE SMALL ESTATE.

"A" is a man of limited means, having a small amount of capital and a small income. Consequently he cannot aim at a big acreage under coffee nor can he afford to develop rapidly. Let us suppose that his ultimate aim is 100 acres of coffee; that he will put in 20 acres at once and thereafter a further 10 acres each year. He intends to work hard himself and to be substantially self-supporting, being content with a couple or so of good round huts or a small house of wattle and daub, which he will build largely himself, making use of any timber that his estate possesses.

His expenses in order to bring his estate to a self-supporting basis will be somewhat as follows:—

First Year.

Capital:

150 acres at £2 per acre	£300
Survey and transfer fees, title deeds, etc	40

Stock:

(12 oxen, 2 cows, one with calf)	110
One cultivator, one cart, Gear, Single furrow Plough, implements & tools	105
Clearing and Planting 20 acres (light clearing) at £2.10.0 per acre	50
Purchase of 12,000 coffee plants at Fls. 25/- per 1,000	30
Lock-up store and maize crib	20

Working Expenditure.

Upkeep of 20 acres of coffee at £2 per acre including planting and harvesting of maize, as a catch crop in the coffee	40
Non-permanent buildings and boys' Huts	15
Coffee Nursery and Vegetable garden, seed	12
Stock and carting	20
Sundries at £2 per mensem	24

Receipts:

Value of 80 bags Maize at Fls. 4/25 per bag	34

Second Year.

Capital:

Clearing and planting 10 acres at £3 per acre ..	30

Working Expenditure:

Upkeep of 30 acres of Coffee at £2 per acre, including planting and harvesting of maize as a catch crop in the coffee	60
Coffee Nursery and Vegetable garden, seed	12
Stock and carting	30
Repairs and renewals at 25 per cent. of £105	26¼
Sundries at £2.10.0 per mensem	30

Receipts:

Value of 200 bags of Maize at Fls. 4/25 per bag ..	85

Third Year.

Capital:

Clearing and planting 10 acres at £3 per acre ..	30

Working Expenditure:

Upkeep of 40 acres of coffee at £2.10.0 per acre, including planting and harvesting of maize in 20 acres	100
Coffee Nursery and Vegetable Garden, Seed	12
Stock and carting	30
Repairs and renewals at 25 per cent. of £105 ..	26¼
Sundries at £3 per mensem	36
Preparation, transport and charges on 1 ton coffee Sold locally	10

Receipts:

Value of 120 bags of Maize at Fls. 4/25 per bag ..	51
One ton of coffee sold locally	60

Fourth Year.

Capital:

Clearing and planting 10 acres at £3 per acre ..	30
Purchase and erection of one pulper (hand power) and vats	125
Trays and mats	5

Working Expenditure:

Upkeep of 50 acres of coffee at £3 per acre including planting and harvesting of maize in 20 acres	150
Coffee Nursery and vegetable garden	10
Stock and carting	30
Repairs and renewals at 25 per cent. on £105 ..	26¼
Sundries at £3 per mensem	36
Preparation and transport of 4½ tons of coffee at £17 per ton, sold in London	76½

Receipts:

Value of 120 bags of maize at Fls. 4/25 per bag ..	51
4½ tons of coffee at £80 per ton	360

Fifth Year.

Capital:

Clearing and planting 10 acres at £4 per acre ..	40
Purchase of new extra implements and tools ..	25
Small permanent house of say sun-dried brick ..	200
Wagon and four extra oxen	100
Extra Trays and Mats	5

Working Expenditure:

Upkeep of 60 acres of coffee at £4 per acre including planting and harvesting of Maize in 20 acres	240
Coffee Nursery and Vegetable garden	10
Stock and carting	30
Repairs and renewals at 25 per cent. on £105 ..	26¼
Sundries at £4 per mensem	48
Preparation and transport on 9½ tons of coffee at £17 per ton sold in London	161½

Receipts:

Value of 120 bags of maize at Fls. 4/25 per bag ..	51
9½ tons of coffee at £80 per ton	760

SUMMARY.

	(1st Year).		
Capital	£655		
Working expenses	111	Nett Loss	£732
Less Receipts	34		
	(2nd Year).		
Capital	30		
Working expenses	158¼	Nett Loss	£103¼
Less Receipts	85		
	(3rd Year).		
Capital	30		
Working expenses	214¼	Nett Loss	£133¼
Less Receipts	111		
	(4th Year).		
Capital	160		
Working expenses	328¾	Nett Loss	£ 77¾
Less Receipts	411		
	(5th Year).		
Capital	370		
Working expenses	515¾	Nett Loss	£ 74¾
Less Receipts	811		

The above figures should not need much explaining. 25 per cent. per annum is considered a fair depreciation on a combined item, such as is entered in the first year, and this sum, viz: 25 per cent. of £105, is entered in the working expenditure for each year, as the implements and tools will have to be repaired and replaced.

Maize as a catch crop is planted in the coffee for 2 years only; the first year's yield being allowed for at 4 bags per acre, and the second year's at 8 bags per acre.

The building of a permanent house has been deferred until the 5th year.

The yield of Clean Coffee per acre has been reckoned as follows:—

3rd Year from seed.	1 Cwt. per acre.
4th „ „ „	4 Cwts. „ „
5th „ „ „	7 „ „ „

Doubtless some of these figures may be questioned for certain districts, but the object has been to give a general average rather than a specialised figure.

To the above figures must, of course, be added original travelling and hotel expenses and the cost of living for 4—5 years without receiving any profit from the estate.

Living, however, is very cheap in most places away from the towns, and an average £120 a year should suffice for the frugal necessities of a man who is making his estate largely self-supporting.

It is assumed that "A" has had no previous experience, which would enable him to augment his income by looking after some neighbouring estate in addition to his own.

It would seem, therefore, that a planter of the type referred to would require a capital of £1,200, and in addition an income of £200 a year, or if he has no income a capital of £2,000, to enable him to purchase and develop a small estate on the above lines and to live on it himself.

He should, however, be able to obtain extended terms for payment of the original purchase price, if he requires to do so.

From the 6th year onwards he should make a steadily increasing income up to say £1,000 a year when his estate of 100 acres of coffee is in full bearing. The value of such an estate as the above at the commencement of the sixth year would be about £3,500.

The above quoted figure of £2,000 should be regarded as the irreducible minimum in order to allow a small reserve against unforeseen contingencies. Capital not required at once should of course be accruing interest whenever possible.

THE LARGE ESTATE.

This type of estate may be put at 150 acres and upwards under coffee, which acreage will be attained as soon as possible. The district chosen will be one that is already a proved coffee district, and there will be greater existing facilities for transport.

"B" is presumed to be a man of some means, who wishes to combine a pleasant home with plenty of congenial work, and at the same time to make his capital safe and a good income for the future by making a thoroughly first class estate.

Taking all this into consideration the purchase price of his land will be considerably more than in the case of "A".

He will put in say 50 acres at once; 50 acres the second year, and thirty acres in each of the next two years. His house and stores etc., will be permanent, and altogether he will aim at making a substantial and lasting property.

The following is a general estimate to bring such an estate on to a paying basis:—

First Year.

Capital:

400 acres at £10 per acre	£4,000
Survey and transfer fees, title deeds, etc	150
Stock (20 oxen, 3 cows, 2 with calves)	200
One 14ft. wagon, 1 cart, trek chains, etc.	130
Implements, tools, cultivators, maize mill	100
Permanent house, and out-buildings	1,500
Stone store and maize crib	150
Contract for ploughing, cross-ploughing and harrowing 50 acres at £2.10.0 per acre	125
Clearing and planting above at £1 per acre	50
Purchase of 30,000 coffee plants at Fls. 25/- per 1,000	75

Working Expenditure:

Upkeep of 50 acres of coffee at £2 per acre including planting and harvesting of maize as a catch crop	100
Boys' Huts, etc	5
Coffee Nursery and seed Gardens	40
Stock and carting	45
Sundries at £4 per mensem	48

Receipts:

Value of 200 bags of Maize at Fls. 4/25 per bag ..	85

Second Year.

Capital:

Purchase of two ploughs and 1 harrow	110
12 more oxen	96
Clearing and planting 50 acres at £1 per acre ..	50
Ploughing, cross-ploughing and harrowing at £2 per acre	100

Working Expenditure:

Upkeep of 100 acres of coffee at £1.15 per acre including planting and harvesting of maize in 50 acres	175
Coffee nursery and seed. Gardens	35
Stock and carting	50
Repairs and renewals at 25 per cent. on £230 ..	57½
Sundries at £5 per mensem	60

Receipts:

Value of 200 bags of Maize at Fls. 4/25 per bag ..	85

Third Year.

Capital:

Purchase and temporary erection of one pulper and permanent Vats	150
Clearing and planting 30 acres at £1 per acre ..	30
Ploughing, etc., at £2 per acre	60
Trays and mats	5

Working Expenditure:

Upkeep of 130 acres of coffee at £2 per acre including planting and harvesting of maize in 30 acres	260
Coffee Nursery and seed. Gardens	35
Stock and carting	50
Repairs and renewals at 25 per cent. on £340 ..	85
Sundries at £5 per mensem	60
Preparation and transport of 2½ tons of coffee at £17 per ton sold in London	42½

Receipts:

Value of 120 bags maize at Fls. 4/25 per bag ..	51
2½ tons of coffee at £80 per ton	200

Fourth Year.

Capital:

Purchase of one pulper and permanent erection of both; purchase and erection of engine, huller, pumps, etc., and building of factory	1,500
Clearing and planting 30 acres at £1 per acre ..	30
Ploughing, etc., at £2 per acre	60
Trays and mats. Drying shed	25

Working Expenditure:

Upkeep of 160 acres of coffee at £2.10.0 per acre including planting and harvesting of maize in 30 acres	400
Coffee Nursery and Gardens.	27
Stock and Carting	50
Repairs and renewals at 25 per cent. on £340 ..	85
Sundries at £6 per mensem	72
Preparation and transport of 12½ tons of coffee at £17 per ton sold in London	212½

Receipts:

Value of 120 bags of maize at Fls. 4/25 per bag ..	51
12½ tons of coffee at £80 per ton	1,000

Fifth Year.

Capital:

Nil.

Working Expenditure:

Upkeep of 160 acres of coffee at £3 per acre	480
Coffee Nursery and Gardens	27
Stock and carting	50
Repairs and renewals at 25 per cent. on £340 ..	85
Preparation and transport of 29 tons of coffee at £17 per ton sold in London	493

Receipts:

29 tons of coffee at £80 per ton	2,320

SUMMARY.

	(1st Year).		
Capital	£6,480	Nett Loss	£6,633
Working Expenditure	238		
Receipts	85		
	(2nd Year).		
Capital	356		
Working Expenditure	377½		
Receipts	85	Nett Loss	648½
	(3rd Year).		
Capital	245		
Working Expenditure	532½		
Receipts	251	Nett Loss	526½
	(4th Year).		
Capital	1,615		
Working Expenditure	846½		
Receipts	1,051	Nett Loss	1,410½
	(5th Year).		
Capital	Nil		
Working Expenditure	1,135		
Receipts	2,320	**Nett Profit**	**1,185**

It will be seen from the above that "B" will work in a somewhat different manner to "A". Maize is only planted in the coffee for the first year after planting.

"B's" intention from the beginning is to aim at a permanency in everything, so that the value of his estate will rise very rapidly at the start.

From the above estimated figures "B" will require £10,000 capital available, if he elects to pay for his estate in full, and it is supposed that he will also have other means on which to live. The value of such an estate as the above at the commencement of the sixth year will be about £15,000.

These two hypothetical examples must be taken as more or less the two extremes, where a single individual, who intends to make a home out here is concerned. The majority of newcomers will probably come within these two types, and a little calculation will readily show what size of estate and what rapidity of development can be achieved with the amount of capital available in each case.

CHAPTER III.

ON MAKING THE CLEARING.

Having made his selection of the piece of land most suitable to open first, the planter must begin operations for clearing the land of forest or bush, and preparing it for planting with coffee.

CUTTING THE BUSH OR FOREST.

If the land is covered with bush only, the clearing is straight forward and easy. Cut over the area first and leave the vegetation spread until dry. Collect into small heaps, take out the bush stumps and burn altogether. The more fires made within reason the better, as the resultant ash will be the more widely distributed to the good of the soil.

This is especially the case with forest land, in which the Humus or top layer of decayed and decaying vegetation is apt to be sour.

If the land to be cleared is covered with forest and the planter wishes to make a clean sweep of it and to plough, then fell all the trees by cutting the roots, by which means the leverage of the standing tree is utilised. Do not fell the trees first by axing them above ground, afterwards taking out the stumps. It would be no exaggeration to state that the latter requires nearly 3 times as much labour as the former, and should only be employed when the forest trees are to be sold in the log for timber and the land, on which they stood, will not be required for planting for some time. In such a case as this, the stumps may gradually be removed by several means.

CLEARING WITH SQUATTERS.

The simplest method of getting the land cleaned and a few of the smaller stumps taken out is by parcelling it out to Native Squatters. These squatters will burn up the brushwood, take out a few small stumps and roots and plant crops of maize, beans, wembi, matama, sweet potatoes, etc., all of which will get the soil into working order. They are very useful to have on the estate, as they form a reserve of labour supply, which under the Squatters Ordinance is bound to work for the employer for 6 months in the year should such labour be required.

Of course, when the planter wishes to plant up with coffee this land that has been at least partially prepared for him, he still has to face much of the stump clearing difficulty.

STUMPING JACK.

If there are several planters within a reasonable distance, who are clearing land in the same manner, a co-operatively owned Stumping Jack would undoubtedly be of inestimable value as regards saving of labour and time. The need for all such labour saving appliances, when they can be afforded and usefully utilised, is most imperative.

SALTPETRE AND SULPHURIC ACID METHODS.

Two other methods of removing stumps are by treating them with Saltpetre or Sulphuric Acid. A hole is bored in the top of the stump and a measured quantity of either of the above, according to the girth of the tree and density of the wood, is poured in and the hole tightly corked.

The Sulphuric Acid acts as a destroyer, and the stump gradually crumbles away in the course of some months, while the Saltpetre saturates the wood and renders it very inflammable so that it can easily be burned out right down the roots.

PARTIAL CLEARING.

Owing to the growing acceptance of the principle that shade is necessary for coffee in this country and the consequent increasing interest in indigenous trees, it is hoped that it will soon be possible for the planter to know that certain trees may be left standing, when the rest of the forest is felled. The Wild Coffee in Kenya invariably grows under forest shade, wherefore it may be safely argued that there must be many indigenous forest trees, which are suitable to be the mother trees of coffee.

The great advantage of leaving some of the forest trees that are known to be suitable is that the Coffee plants will have the benefit of at least partial shade from the very outset.

At the same time, the difficulties of lining out will be increased and occasional coffee plants will have to be left out on account of tree trunks, but the advantages greatly outweigh the disadvantages.

When partially felling forest, do not leave very tall trees as this only increases the number of trees required to give the right amount of shade, since, the folliage of the very tall tree being at an entirely different level, other trees must be left or planted close by in order that there shall not be a gap at certain times of the day.

It is best to leave young trees and of different varieties next to one another, whenever possible, as they will be more easily regulated as they spread.

WORKING THE SOIL.

It is now presumed that the land is either completely or partially cleared. In the former event it will be ploughed, harrowed, cross-ploughed and again harrowed. In the latter it may be jembied, beaten out, and perhaps again jembied after planting has been completed.

PLOUGHING AND HARROWING.

In the former case ploughing contracts are taken on at an average price of £2 10/- per acre, where the land has been thoroughly cleared of roots, etc. If the planter does his own ploughing he should save at least 10/- per acre.

In land where there is 'couch' or other bad grass, the first ploughing should be shallow, say 4 inches, and sufficient time should be allowed for the grass to die before working the soil again. The second ploughing should then be done deep, say 10 inches to 1 foot.

DIGGING AND BEATING OUT.

In the latter case the land is dug over with jembies. A boy can dig to the full depth of a jembie (first digging) from 120-200 square yards per diem according to the nature of the soil and the number of roots encountered. The cost of this work is, therefore, from Fls. 5/25 to 8/75 per acre taking the average cost of a man—posho included—to be Fls 6/50 per mensem.

The beating out is done by breaking up the clods and shaking out and collecting the roots by means of sharpened sticks. Women and children are quite good at this work, which should not cost more than Fls. 3/- per acre.

The second digging, which in most cases of forest land will not be necessary for some little time after the first digging, should not in any case cost more than Fls 5/- per acre.

In the first method labour is saved on the initial working and in lining out, but more is necessary to plant up the shade afterwards. In "forest" land however working the soil to such a degree is unnecessary. In the latter method a small saving in expenditure is effected and the young coffee plants have the great benefit of shade from the beginning.

DRAINING.

One of the primary requirements of coffee is a well-drained soil. If the texture of the soil is light and friable, the natural drainage will be sufficient.

If, however, the texture of the soil is heavy and somewhat clayey or if there is any reason to believe that it may be water-logged a few feet below the surface, a system of drainage should be laid out. The depth of these drains will depend on the nature of the soil, but should err on the side of depth rather than shallowness. The main drains should lead directly down-hill, and may be placed 100 yards or so apart with side or feeder drains branching off on either side and running slightly uphill along the contour of the land. These drains will further be exceedingly useful in stopping the washing away in heavy rain of much of the very valuable top soil in the case of steep slopes.

When the soil has been worked by plough or jembie, the land will be ready for lining out.

CUTTING PEGS.

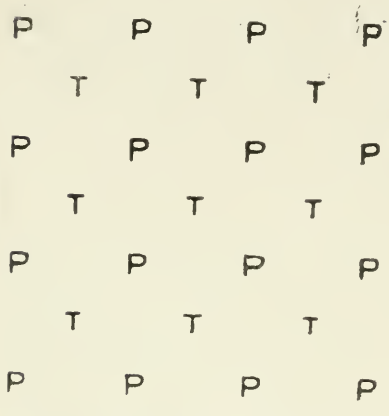
A large number of strong, straight sticks—one for each coffee plant—about 3½ feet long and ¾ to 1 inch in diameter should be cut ready. A boy should cut and sharpen at one end 300 sticks a day, if there is a fair amount of sapling under-growth in nearby forest.

DISTANCE OF PLANTING.

The distance of planting in this country will vary from 8ft. x 8ft. to 10ft. x 10ft. To determine this, conditions of altitude, soil, rainfall, etc., must be considered, as they all bear directly on the size, to which the trees are likely to attain,

when treated on the ordinary single stem system. A rich soil at an altitude of 5,500 to 5,800 feet would require planting 10ft. x 10ft. while, for an average soil of 6,000 feet and upwards, a distance of 8ft. x 8ft. would probably be sufficient.

When such systems as the "Agobiada" are being used, these distances do not apply.



P—Permanent Plant.
T—Temporary „

A method which may be successfully employed if the planter has a considerable number of coffee plants to spare is as follows:—A plant is put in the centre between every 4 trees thus doubling the number of plants per acre, as in the diagram. Cultivation for a few years is done in the diagonal lines, which are temporarily the widest. These intermediate plants are not pruned in the same manner as the permanent plants, but are allowed to bear as heavily as possible. The lower primaries will die off and the crop will be borne higher and higher up the plants, thus interfering but little with the growth of the permanent plants. After 3 or 4 years these plants are taken out altogether and the permanent lines are left.

LINING OUT.

There are several systems of lining out to suit each man's individual fancy. A detailed description of one, the square system, only will be given, as the method is substantially the same in each case.

Two chains are used if possible in this system, which is the most accurate for broken land or where trees are left standing. These chains should be marked at the correct distances by pieces of white or red tape tied into the link, as they are much more easily seen than the usual brass tabs, with which these chains are marked. It is important to see that links do not become crossed, so lessening the distances. There is not much fear of this with new chains, but with old and rusty chains this frequently occurs and they should therefore be rubbed bright and oiled before use.

THE SQUARING SYSTEM.

Lay out a base line running east and west and roughly bisecting the clearing. Fill in at the correct distances with the sticks, which have been cut for the purpose.

Having laid out the base line, it is necessary to lay out another at right angles to the first.

Select a suitable section, as near the centre of the clearing as convenient and where the ground is fairly level. Place the ends of a chain say 6 sticks apart, i.e. leaving 5 sticks between the two ends; then draw out the centre of the chain until the two halves are taut. Place a stick in the ground at the apex and repeat this operation on the opposite side of the base line Mark out this line in the correct distances as before. It will be as well to check these lines a little further out from the base line, as a slight inaccuracy here will become more pronounced as the squaring continues.

If 2 chains are in use, the quickest method is to set out skeleton squares as follows:—

Supposing that 10ft. spacing and 100ft. chains are being used, place 2 boys each having one end of one chain 10 sticks up 2 of the lines that are at right angles to one another. Draw out the other ends of the chains until they meet when taut. These lines are then marked out with sticks and a skeleton square has been formed. These squares can be filled in afterwards by boys with a single chain, when they have been shown how to do it. This is so simple that it needs no description. The boys holding the chains must be explicitly instructed not to tighten or release the chains while the lines are being marked out. When lining across a depression, the chain must be drawn as taut as possible. The spacing therefore in these depressions will not be the same as on the level. The best way of finding the right spot for a stick, where the chain is at a height from the ground, is to drop a small stone or a hard piece of earth from the mark on the chain and put the stick into the ground where it falls.

By these methods the clearing may be quickly marked out by the planter and the boys left to fill in the squares. Great care should be taken that everything is done with accuracy, for an unnoticed error at one point may easily necessitate the undoing and reconstruction of an acre or so of skeleton squares.

If a clearing has been carefully lined, 8 clearly defined lines should be observable in each quadrant from any stick well inside the area.

A well lined clearing gives the planter a feeling of intense satisfaction and pride in his estate.

OTHER SYSTEMS OF LINING OUT.

Other systems of lining out are the Triangular, the Parallel and by Quincunxing. The first two explain themselves by their titles. The Parallel and the Quincunxing systems can only be used with effect where long stretches of level land are to be lined out; parallel lines at definite distances apart being laid out and the sticks put in at the required distances in the former case opposite and in the latter case alternated.

TABLE OF NUMBER OF TREES TO AN ACRE.

It may be found useful at this juncture to give a table of the number of coffee trees to the acre at various distances:—

Spacing.	No. of trees to the acre.
8 ft. x 8 ft.	681.
8 „ x 9 „	605.
8 „ x 10 „	544.
9 „ x 9 „	538.
9 „ x 10 „	484.
10 „ x 10 „	436.

ROADS AND PATHS.

When the lining out is finished or during its course, the planter must consider his road system. An insufficient supply of roads and paths in a coffee estate is much to be deprecated, and is an entirely false economy. Many factors go to make up for the actual loss of a few trees, and far more than compensate for the small loss of yield per acre. The coffee trees along the roads and paths will usually grow larger and crop more heavily; greater facilities for working; more thorough viewing of the fields—these are a few of the compensations received.

A path, i.e. one line of trees left out at intervals of every 20 lines one way and a cart road at intervals of every 50 lines the other way will be found a very convenient plan.

Acreages can very easily be computed for such work as manuring, spraying, etc., and a plan such as the above will be a source of great convenience and increased accuracy in working and estimation to the practical planter.

PITTING OR HOLING.

The pitting should be begun as soon as possible after the lining out has been completed and the pits should be left open to the action of the sun and rain until near to the time of planting. This will sweeten the soil considerably. In most soils the pits should be made not much less than 18 inches x 18 inches x 2ft. deep. Make the boys clearly mark out the pits several inches deep before removing the sticks, as it is surprising how far out of line the pits will be made, if this is not done.

The 'panga' is but a poor tool for this work. An earth drill would be useful to make holes at the right places, but the holes thus made would be of insufficient size and would have to be enlarged. In S. India this work of pitting was very frequently done by contract, the coolies receiving 1 Anna for every 8 pits of the above dimensions, and it was no uncommon thing for a cooly to average over 6 Annas (equals 6d.) a day in a by no means light soil. The cost of pitting at this rate is therefore at 1s. 4d. to 1 Rupee:—

4 1/6 Florin cents per 8 pits, which equals
Fls. 3/55 per acre at 8ft. x 8ft. or
Fls. 2/27 per acre at 10ft. x 10ft.

Since this work in India was done by means of mammoties or jembies, and sharpened sticks, there seems to be no reason why pitting in Kenya with its lighter soil should cost more than at the most Fls. 4/- per acre.

Roots protruding through the walls of the pits should be cut back as far as possible.

FILLING

It is advisable to wait—if labour permits—until the rains have begun before filling in the pits. A greater proportion of the earth will then be wet and so the plants will stand a better chance should the rains lift unexpectedly soon after the planting has been done.

Before any earth is returned into the pits the bottoms should be broken up slightly in case hard cakes should have formed there, which would turn the tap roots. The pits should then be half filled with humus or top soil from round the edges and the remainder to well above ground level with the earth that was originally taken from the bottom of the pits.

The sticks should then be replaced upright in the mounds and a rough alignment made both ways to facilitate the planting.

Care should be taken that sticks, stones and weeds are not returned into the pits. A fair day's task for a boy, if the filling is done carefully, is 100 pits; and the cost at this rate is roughly Fls. 1/50 per acre.

CHAPTER IV.

ON SEED AND PLANTING.

IMPORTANCE.

The subjects treated in this chapter are perhaps the most important of all that the planter has to deal with, and consequently too much care and supervision can hardly be given to them. All other work should give way to these whereever possible, so far as personal supervision is concerned—by which it is meant that it is better for the planter to spend a whole day with his planting gang for instance than to spend an hour or two only with them, and then to go off and watch some other work as weeding. Mistakes and careless work at this stage may, and most probably will mean very considerable loss in yield and trees in the future, and a consequent lowering of the value of the coffee estate on account of the large number of unthrifty trees.

It will be advisable to start right at the beginning of the life of those coffee plants that are to make or mar the estate.

CHOICE OF THE SEED.

Throughout the choice of the seed, keep these two words well in mind. "HIGH AVERAGE." It is far better to aim at and to attain this quality than to make a collection of enormous beans, which will frequently turn out to be mal-formed.

To be quite sure of getting good seed requires intimate knowledge of the estate for a period of at least two crops.

The reason of this may not be perfectly obvious, but the explanation is that a tree which is looking quite strong and healthy at the final stage of a crop, i.e., when the berry is ripening, may still have been affected by a previous drought or some such set-back at the beginning of the crop, which weakness will more than probably be reproduced in the seed. Seed should not be taken from either very old or very young trees. There is no very old coffee in this country but it is quite possible that on some estates, where no manuring has been done, the oldest trees may have begun to lose some of their vitality.

The maiden crop should not be used for seed either, for the reason that young trees have not proved their capabilities.

It is as well not to take seed from trees under five years old, if there are older trees to select from.

The planter should first of all select carefully a piece or pieces of coffee which have cropped steadily for the previous two seasons, and which have consistently looked healthy.

Seeds should not be taken from the trees that have over-cropped and subsequently gone back, for there will almost certainly be weakness in the seed.

The piece or pieces from which the seed is to be picked, having been selected, the choice of trees is proceeded with in the same manner.

Only trees that are looking dark-coloured and healthy, and on which there is no disease apparent, should be chosen.

Do not pick large round berries, as the boys love to do, for these generally contain three beans, which are mal-formed from the seed selection point of view.

Pick only good, bright red cherries that are slightly flattened on two sides and do not take too many from any single branch or even tree.

A double handful from any single tree is sufficient.

A tree should never be completely stripped of all the cherry that is on it.

Only the very best and most intelligent boys on the estate should be employed to pick the seed coffee, and even such boys as these should not be able to pick much more than half a "debbie" (kerosene oil tin) a day, if carefully selected.

When picked the cherries should be so even in size that they would appear to have been graded.

This, then, is the rule of High Average quality:—Select a good average piece of coffee, choose good average trees therein, and pick only a limited amount of good, average, bright-ripe cherry from each of these trees.

PREPARATION OF THE SEED.

To prepare this seed, the cherries should be trodden under foot in order to separate the seeds from the pulp. They should never be put through a pulper and so run the risk of being bruised

Put the seeds into water, stir well, and take off all that float. Drain off the water and turn out the remaining seeds on to a sieve, mat or boards, in a wellshaded spot. Mix finely sieved wood ashes with the seeds thoroughly, to enable the saccharine matter on the parchment to assimilate as much of this ash as possible.

Dry slowly in the shade and from time to time mix more dry ash until all the seeds have a dull bluish-grey appearance.

This coating of ash and saccharine matter keeps the parchment from splitting in the usual way, and, in consequence, the bean inside preserves a more equable degree of humidity, thus extending its life or power of germinating.

If it is required to keep this seed for some months, it is advisable to seal it up in tins.

When the seed is thoroughly dry it should be carefully picked over and all pea-berry, elephant-berry, three-sided or other mishappen and marked beans taken out.

There will then be left an even sized sample of flat-faced round-backed, bold coffee seeds, which represent the ultimate aim of the planter, namely to produce a perfect sample of high average quality coffee, with which to perpetuate the good name of the estate.

It will generally be found that better results are obtained if the seed put down is from a different altitude and climate, as inherent qualities may be supplied, in which the planter's own estate may be lacking, while the plants themselves will assume the superficial qualities of that estate.

The planter, however, should make sure that the coffee is good from which the seed is taken and that the seed is carefully selected and he would do well, if it is reasonably possible, to inspect some of the seed before buying.

Seed that appears to have been put through a pulper or which has obviously not been selected, should not be used, except as a last resource, and must be picked over very carefully before being put down.

CHOICE OF NURSERY.

Select a level or very gently sloping piece of land, handy to water, and if possible, sheltered but not shaded by trees.

Branches of trees that may overhang the beds in the nursery should be cut away, as the drip from such a height will wear away the soft earth of the beds and so expose and injure the roots of the young plants.

At this juncture it may be as well to state that plants can be grown with much less trouble and attention than is suggested in the following pages, and these descriptions are intended for those planters who are willing to go to a certain amount of trouble and a small amount of expense in order to give their young coffee plants the best possible start in life.

SEED BEDS.

Dig up a small piece to a depth of about nine inches, and when a really good, fine tilth has been achieved, make up some slightly raised beds, about three feet wide.

If the nursery site has been chosen in virgin forest soil, mix finely sieved slaked lime into the beds to the amount of about a heaped double handful per two feet of bed. If the soil has been much used previously, give a generous dressing of old, dry cattle manure, also finely sieved, in addition to the lime.

It is important that there should be no impediments in the shape of stones or hard lumps of earth to hinder the tender tap roots of the seedlings from growing straight downwards.

SOWING THE SEED.

Lay out the seeds on the surface of the beds about an inch apart and flat side downwards. Then press in about three-quarters of an inch with the finger or thumb and smooth the earth over lightly.

Cover with a good thick layer of dry grass of not too heavy a texture and water.

No overhead shade is required at this stage. The beds should be well watered every evening, unless there has been rain.

A rough guide to the area of seed beds required at the above distance of sowing can be given at four feet of bed to every pound of seed.

When, after six to eight weeks, the seedlings are observed to be pushing up into the grass, this should be carefully removed so as not to damage to seedlings and a part of it placed on a low framework about one and a half to two feet from the ground.

PERMANENT BEDS.

The planter must now start getting his permanent beds ready.

All the beds should be well raised and a path made between each bed.

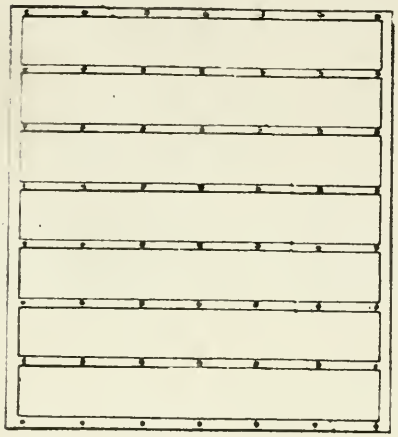
It pays to mark out the beds with string and to make them up accurately, as less plants will be lost at the edge. Space will be economized and it will be much easier to estimate the number of plants in the nursery, if all the lines contain the same number of plants.

A width of three feet six inches is sufficient for these beds, as boys on either side can reach the centre for planting or weeding without having to put hand or foot on to the beds to lean on, which would compress the soil and would damage the plant roots.

PLANTING FRAMEWORK.

If a large number of plants are to be put in and it is expected to keep up a considerable nursery over a number of years, it is a good plan to make a rectangular wooden framework say three feet three inches wide by three feet eight inches in length.

To this fix six cross pieces at six inches apart, thus making eight cross-bars in all. In each of these bars, leaving one and a half inches at either end, are bored seven holes at six inches apart and into each hole is fixed a pointed wooden peg.



The frame is placed carefully in position on the beds and pressed slightly downwards. Remove the frame and the correct position for fifty-six plants will be marked on the beds at the convenient and satisfactory spacing of six inches by six inches.

Orderly, neat rows will be obtained by this method and two boys can mark out the beds at a great speed. Since the framework is permanent, the cost of construction is negligible.

OVERHEAD SHADE.

An overhead framework of about five feet high should be erected and lightly covered with grass, branches or sticks. It is not required to shut out the light completely, but rather to break up the force of the sun's rays, and it is also important to allow as free a passage of air as possible through the nursery.

TRANSPLANTING SEEDLINGS.

When the seedlings are well up in the seed beds and most of the primary leaves have opened, they are ready for transplanting into the permanent beds.

If the germination is good and the growth of the seedlings has not been obstructed in any way, almost all will open within a few days of one another and the beds will be thickly covered with green.

Dig a small trench about four inches or so deep at one end of a bed and then prise the seedlings out gently, so as not to break more of the tender feeling roots than can be helped.

If a good tilth was made originally both top root and side roots should come out easily and nearly intact.

The tap-root of every seedling should be examined, and if bent or too long and limp, should be pinched off at three inches or so, in order to make the root sturdy and straight. Care must be taken not to expose the roots of the seedlings to the sun.

The seed beds should be watered before the seedlings are taken out, and also the permanent beds into which they are to be put.

Supply each boy with a smooth pointed stick, six to eight inches long and one inch thick.

The beds having been previously marked out with the frame, each hole is clearly defined, and merely requires deepening.

Make the holes four to five inches deep with the sticks, twisting them round in the holes so as to make the sides smooth and prevent the earth from dropping back and so turning the tap-roots through the holes not being deep enough.

Put the seedlings right down into the holes and then lift up slightly to the right level. This will ensure that the tap-roots are straight.

Press the earth firmly round the seedlings and mulch the beds lightly with leaves or dry grass. Grevillea Robusta leaves cannot be beaten for this.

To test whether or not the seedlings have been firmly planted, take hold of the tip of a young leaf and lift gently. The leaf should break before the plant lifts out.

CARE OF THE NURSERY.

The surface soil of the beds should be worked over frequently so as to keep a good tilth and keep down weeds, and after a few months a light dressing of lime and old, dry cattle manure can be worked in with advantage to the plants.

The mulch should be replaced as it rots, for this prevents the soil working up round the stems of the plants when watered.

For the first two or three months the plants should be watered early morning and evening, except of course when there is rain, and then dropped to once a day. Decrease gradually until about nine months old; if the climate is not an exceptionally dry one, two to three times a week will be sufficient.

The overhead shade should likewise be gradually lightened and finally taken off altogether a couple of months or so before planting in order to harden the plants off.

AGE FOR PLANTING OUT.

The most suitable age, at which to put out plants into the clearing, is from nine to twelve months.

They will, if reasonably well grown, have got over any slight initial weakness and will be in a vigorous condition. On the other hand, they will not be so large as to receive a serious set-back if a dry spell comes along soon after planting.

Quite good results are sometimes obtained from planting either younger or older plants, especially if in the latter case they are cut down, but as a general rule nine to twelve months' old plants are the best.

ROOT PRUNING.

When the time has come for planting, take the plants out of the bed in the same manner as the seedlings were extracted from the seed beds, viz:—by digging a trench up to the plants and then levering them out.

The trench in this case should be not less than a foot deep.

Strong foot forks are the most useful for this.

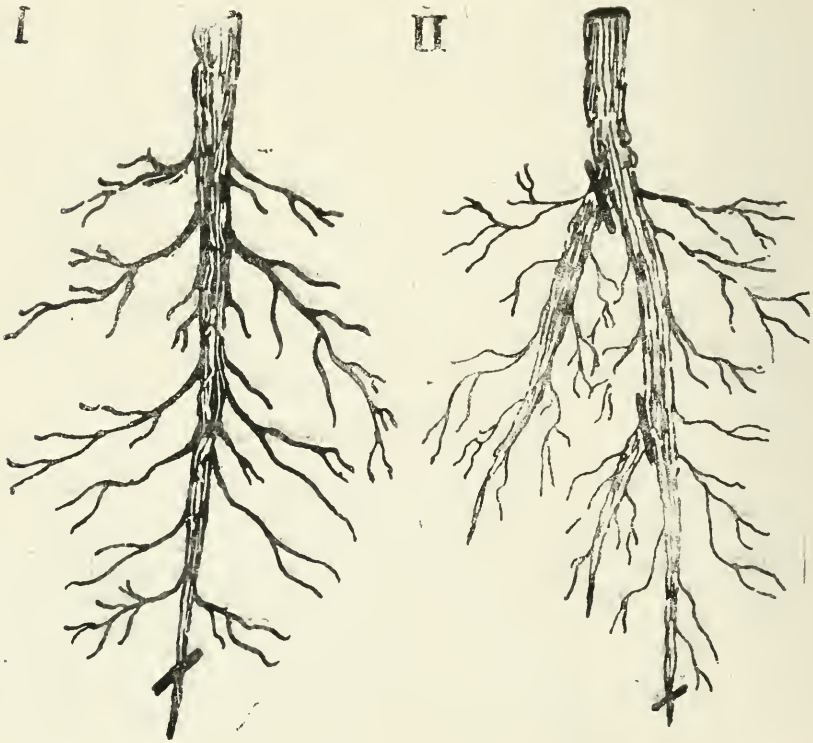
Shake the earth off the roots and examine thoroughly.

It is of the first importance that no plant with a seriously defective root system shall go into the estate.

The main object of root pruning is to induce one strong tap root to grow straight downwards. The diagrams given illustrate some of the usual types of root systems encountered.

No. I. Is a good, well developed system which requires no pruning beyond nipping off the tap root at the marked line in order to stiffen it and so lessen the liklihood of bending during the planting out.

To gauge this stiffness press the top of the tap root against the thumb, as if trying the sharpness of a knife point; when a distinct resistance is felt the tap root will be sufficiently strong and need not be cut back further.

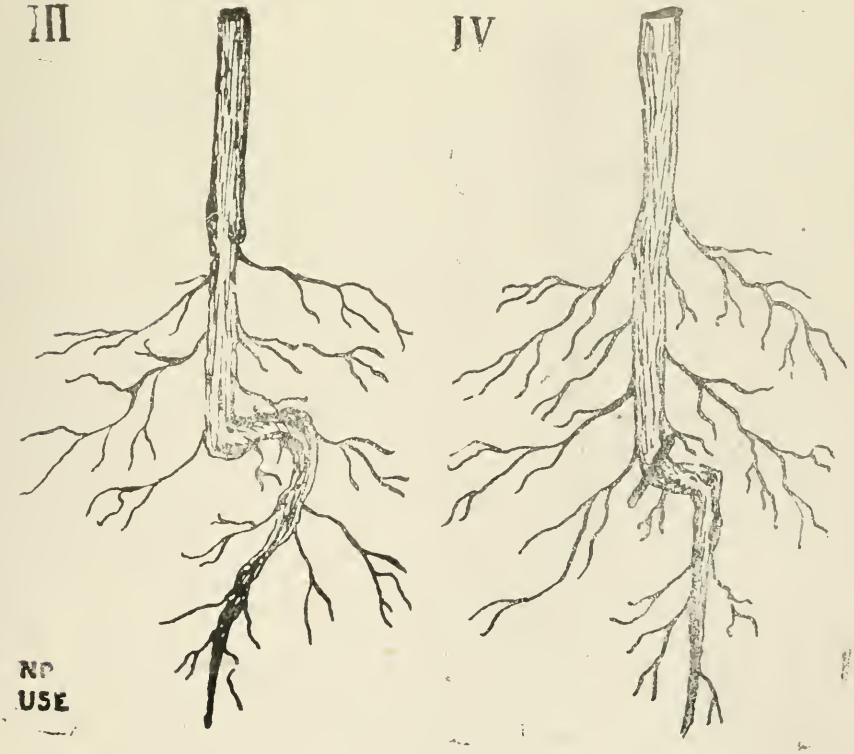


No. II. No II. gives an example of auxiliary tap roots, which are not required, and which should be cut off close to the main roots as marked.

No. III. Shows a plant which is badly turned high up the root. Nothing can be done with a plant like this and it should be discarded.

No. IV. Gives an instance of a bend in the tap root some way down, leaving enough straight tap root and side roots to sustain the plant, when the root is cut above the bend as marked.

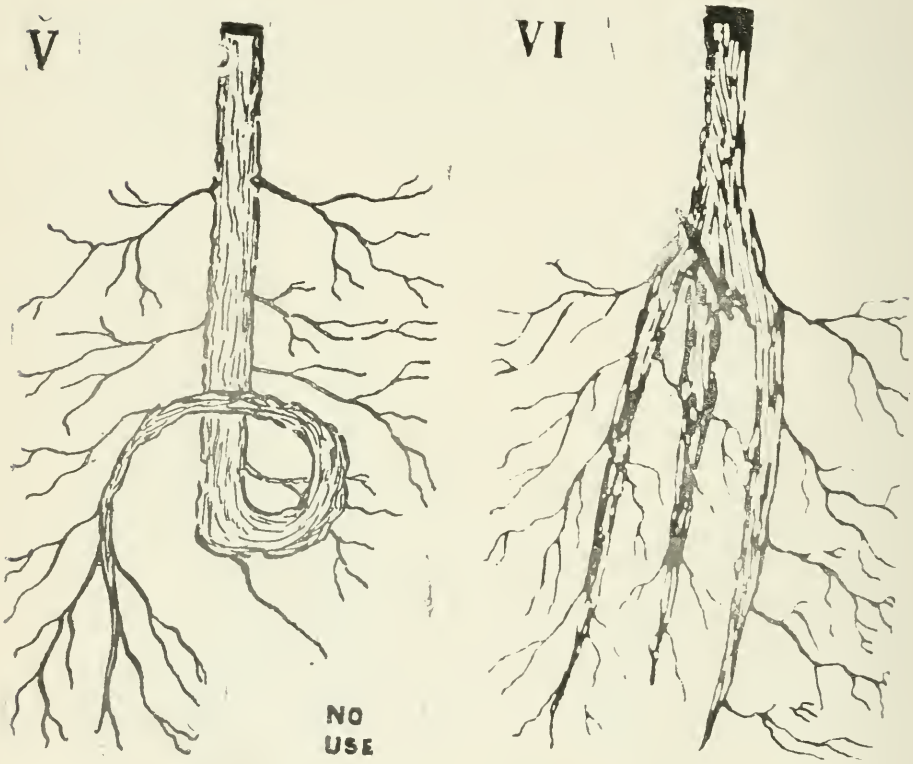
It would be as well to note here that in cases where large plants have to be cut as high up as this, the stem should also be cut down, in order to relieve the depleted root system of the strain of supporting the foilage of the full plant.



No. V. This is of no use whatsoever. It may very possibly grow reasonably well, but it will die back at the first good crop and will have to be taken out, having occupied valuable space in the estate uselessly for perhaps some years.

No. VI. is not uncommon. Such plants frequently reflect their root system in their growth above ground, and will give a thick stunted plant with several stems all competing with one another.

The tap roots, likewise, will be thick and short, so that it is advisable to cut away all except one, which will then have the opportunity of growing down to the proper depth.



Never use a blunt knife for pruning the roots.

Always cut downwards and towards and against the thumb for steadiness, cut close and very carefully.

Long, straggly side roots may also be cut well back.

REJECTION OF PLANTS.

Besides the plants that are discarded, on account of defective root systems, others may also have to be rejected for other reasons. First of all—unless Blue Mountain Coffee is being grown—discard any plants that shew bronze or red coloured young leaves.

These are hybridised with a Nyassa type and are found to produce a poor quality of coffee, although the plants are usually found to be very vigorous.

Secondly—plants that have twisted or damaged stems are no better than those with twisted or damaged roots and should not be planted in the estate.

Thirdly—the small very bushy plants with long thin leaves, and whose primaries are placed very close together. These may have been produced from male seed (this is a theory only), but at any rate, they grow into short, thick, densely foliated trees, which bear but a very small crop and are not worth while planting out.

BALL PLANTING.

This is a method which has many supporters. The plants are lifted out of their beds with a ball of earth round the roots, and are carried out to and planted thus in the estate.

The great advantage of this is that the side or feeding roots are but slightly disturbed and in consequence the plants do not get so much of a set-back and there is less chance of the tap roots being again turned by bad planting.

The writer does not, however, advocate this method for the following reasons—except perhaps for planting in the short rains, if they are likely to be scanty:—

No inspection of the roots can be made, the only thing possible is to pull the tap root and, if this gives considerably, to discard the plant.

Many very badly bent tap roots will, however, not give appreciably when pulled, and especially when surrounded by earth; consequently bad plants will pass into the estate.

Slightly defective root systems as in figures II., IV. and VI. cannot be helped and strengthened.

Boys will be less careful not to break the side roots in taking out the plants, as earth pressed round will hide such carelessness.

It costs much more in labour to carry out ball-plants to the estate.

For these reasons the planter is advised, whenever the rains permit, to examine and prune the roots of his plants before putting them into his estate.

PLANTING OUT.

If any disease, such as Leaf Disease, is observed on the plants in the nursery, a very good plan on taking them out is to dip the foliage of each plant into a receptacle (not of iron) such as a galvanised bucket containing a weak solution of Bordeaux Mixture; half strength should be used. See Para. on Bordeaux Mixture, Chapter VIII.

Do not attempt to start planting before the soil is thoroughly wet for fifteen to eighteen inches below the surface.

Take out the stick that marks the position for a plant and make a deep hole in the soft earth with hand or trowel.

Put the plant well down into the hole, and against one side, and then lift up slightly, until the nursery mark is just below the ground. Fill in the hole with earth.

Thrust a panga or broad flat piece of wood into the earth, about nine inches to a foot away from the plant, and sloping slightly towards it. Press the handle firmly and without jerking towards the plant, holding the stem meanwhile between two fingers of the other hand with the palm flat on the ground. Repeat this process on the other sides. Fill in the holes thus made and tread round the plants with the feet about nine inches away, again firmly but without stamping.

The plant will thus be set straight and firmly in the ground. Smooth the earth around the plant so that it slopes gently away from the stem on all sides.

Replace the stick close up against the step, when the plant is tall and slantwise on the side directly opposed to the prevailing wind, thus supporting the plant and preventing it from becoming "wind wrung".

Shade with bracken, papyrus tops or evergreen branches for a few days. If a quantity of straw, dry grass or leaves is handy, the plants will be materially aided by mulching thickly round them with some such material, which however should not be heaped up close against the stem of the plant.

Only good and intelligent boys should be used for planting and they should not be allowed to hurry and so risk doing bad work. Also they should be supervised the whole time.

An ordinarily good boy should plant about two hundred plants a day carefully.

Do not try and break the record by planting up a large acreage in one day, for the plants will mostly die, if a dry spell happens to come along, and even if not at once the coffee itself will proclaim the bad planting, when in the future the trees fail to bear their ordinary crops on account of twisted or damaged roots.

The following general estimate may be a useful guide. From one pound of fresh seed the planter may expect to get about 1,500 plants fit to be put into the estate.

CHAPTER V.

ON THE CARE OF YOUNG COFFEE.

CULTIVATION.

It as well to leave a short time between planting and the beginning of cultivation, in order to allow the first crop of weeds to germinate.

When the ground is just beginning to appear green the cultivators should be put into the clearing and so the first main crop of weeds will be destroyed. It is advisable to use single ox cultivators only, as less damage will be done to the primaries of the young trees than when 2 oxen are used.

The aim of cultivation should be to clean the estate completely, as soon as possible, and this in the fullest sense. By this it is meant that the estate will be clean when all the dormant weed seeds, of which the soil is full, have been eradicated and this can only be done by allowing them to germinate and destroying them before they can seed again.

There is an old saying to the effect that one seeding makes seven seasons growth; hence the importance of not allowing the weeds to seed.

Where cultivators are in general use, the weeds in front of the cultivating should be kept under observation lest any of the spreading weeds and deep rooted grasses may be establishing themselves, for it is probable that these might not be noticed after the cultivators have passed and might thus gain time to establish themselves firmly.

Whenever couch grass is observed, the planter should note the spot and send boys at once to dig it out thoroughly with pointed sticks. No cutting instrument such as a panga should be used and the roots of the couch should be followed as deep and as wide as they can be traced. Do not be sparing of labour in order to eradicate it completely, for it is one of the worst of pests and terribly expensive to deal with when once it has got a firm footing in the coffee. Light pronged forks are useful for digging deep rooted grasses and weeds out of roads, etc., but it is not advisable to use them near coffee trees that have attained to a fair size.

Even when cultivators are used, they can only clean the middle of the lines, so that round the trees themselves the weeding must be done by hand. This is perhaps just as well on the whole as weeding by hand must always be the more effective and careful method, though slower and more expensive.

FENCING AND TRENCHING.

These two protections to the young coffee should be given whenever funds and labour permit.

The double protection of a 3-strand fence and a 2ft. x 2ft. trench right round the intended boundary of the coffee estate is quite worth while. In fact it could be called a capital improvment in either case provided that both are kept in order.

The former will prevent to a certain extent the straying of oxen and larger game into the estate, where they may cause not a little damage. There are few things so annoying to the planter as the finding of several nice young trees trodden over or with primaries broken by straying oxen.

The latter will prevent the encroachment of couch grass from outside.

FIRE-PATHS.

Another protection, which should be considered in grass-land countries, is the making of firepaths. This consists in keeping a belt of some 25 feet clear of grass and undergrowth during the dry weather. There is no reason why it should not be utilised for a short lived catch crop, if required, and then ploughed or jembied up before the danger of grass fires begins. They must be kept clean, however.

WIND BREAKS.

Where coffee is exposed to the full force of a strong prevailing wind, it will be necessary to plant wind-breaks. These should be at least 50 yards away from the coffee and should never be planted through the coffee as has been done in so many estates in Kenya. The result is an entirely still "airless" area in which any and every disease and pest will develop. Coffee requires protection from the driving force of a strong wind, but it is equally important that it should have the benefit of the full current of air.

Grevillea Robusta trees planted in 2 lines alternated at say 15 feet spacing make an excellent wind-break.

PROTECTION AGAINST CUT-WORM.

In districts where the Cut-worm (Prodenia Litura), of which there are two or three species, are prevalent, one of the first works to be done after the planting is to protect the young trees from the ravages of this pest.

A fuller description of the Cut-worm and the methods to be employed against it are given in the Chapter on "The Insect Pests," but a short outline will be given at this point.

Shields made of dry banana stems with a breadth of about 5 inches are made. The expense of these is insignificant, as a boy can, if he tries and the bananas are handy, make up to 1,000 shields in a day. These are tied round the stems of the plants and in such a manner as to form a complete barrier and yet to allow plenty of space inside. They should be placed about 1½ inches underground in order to prevent the cut-worms from reaching the stems.

Do not cultivate too close to the plants as the earth may thus get heaped up round these shields and cut-worm be enabled to reach the stems.

A poisoned bait in the shape of Paris Green mixed with crushed maize may also be put down in a circle round each plant.

CATCH CROPS.

In many districts and in many cases where capital is scarce, it will be advisable for the planter to utilise the land that he has already prepared by growing thereon some food ration for his labour while the coffee is young. The most commonly used catch crops are Maize and Beans, although wembi, matama, ground nuts, etc., are sometimes grown with success.

Maize should not be planted at all close to the coffee trees especially in districts with a low rainfall, for although shade for the coffee will be obtained it will nevertheless be detrimental in that it will absorb a great deal of the already scarce amount of moisture.

Quite a good yield has, however, been given by planting the maize 9 inches apart in one line only between the coffee lines: by this method almost as many plants are obtained, as if they are planted in 3 lines at the usual distance apart.

Beans are a leguminous crop and do good to the soil, but both the Canadian Wonder and Rosé Cocos varieties are apt to encourage cut-worm.

Also, since at the present time there is no real trade in beans and they can usually only be given as a ration to labour to a limited extent, it would not be advisable to plant them over a large acreage.

GREEN DRESSINGS.

If the planter can afford to wait for a return on his land until his coffee begins to bear, green dressings might be sown and dug in before flowering with great advantage to the soil. Leguminous plants are used as a rule for this purpose and they therefore serve the treble purpose of:—

1. Enriching the soil.
2. Keeping down weeds.
3. Preventing wash.

These green dressings should be sown broadcast over the whole area when the soil has a good tilth a little before the rains.

They are very quick growers and will more than hold their own with the weeds, which they will largely smother. The best of these green dressings are Crotalariae. Sesbania and Indigoferae. all of which are indigenuous.

PREVENTION OF WASH.

Two very good methods of preventing the washing away of the valuable surface soil from slopes that are under cultivation, in addition to that mentioned in the last paragraph, are the making of Catch-Pits, and Contour Trenches.

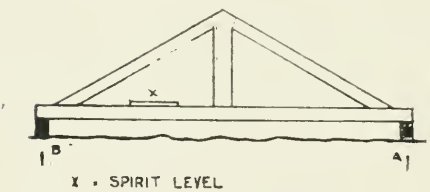
CATCH-PITS

These catch-pits should be dug between the lines of coffee across the slope and in alternated lines. The pits should be 2ft. in diameter and 1ft. deep. They will gradually become silted up and should then be cleaned out and the silt spread over the surrounding land on the uphill side.

CONTOUR TRENCHES.

Contour trenches are dug along the contour of slopes every 2—4 lines apart according to the steepness. A light wood frame—as in the diagram—is used. by which means a rough level is kept thus preventing the collected water from rushing away in either direction.

A small peg at A is driven into the ground, one leg of the frame is placed thereon, and another peg at B is driven down until the level is correct; B is then used for another peg and so on. The trenches are dug out to whatever depth is required —usually 6—8 inches—and the earth banked up on the down-hill side. These trenches are very cheaply made. They are cultivated over during the dry season and remade yearly.



HANDLING.

Until the trees reach the bearing stage no real pruning should be required, if they are looked after properly and handled in time.

Do not use a knife, if it can be avoided; removal of unnecessary growths by hand is very much cleaner and more effective. The centres of the young trees should always be kept as free as possible of suckers and superfluous secondaries to allow a good circulation of air and light.

A primary that is bent to the ground should be cut back to a strong secondary, that has a directly outward and slightly upward tendency. This secondary will take the place of the original primary and its upward inclination will enable the branch to bear it's crop free of the ground. Branches should not be left bent to the ground as they:—

1.—Stop air circulation.

2.—Pick up diseases and pests more rapidly.

3.—Get covered with earth and crop ripens and dries off unnoticed.

By the method above it will often be possible to retain somewhat of the proper shape of a tree that has been badly broken perhaps through careless cultivation.

DISBUDDING.

Where the soil is not unusually rich and the rainfall plentiful, or where the young trees are tall and not very sturdy, disbudding should be carried out directly the "spikes" of the first blossoms are formed. The disbudding consists in rubbing these spikes off with the fingers.

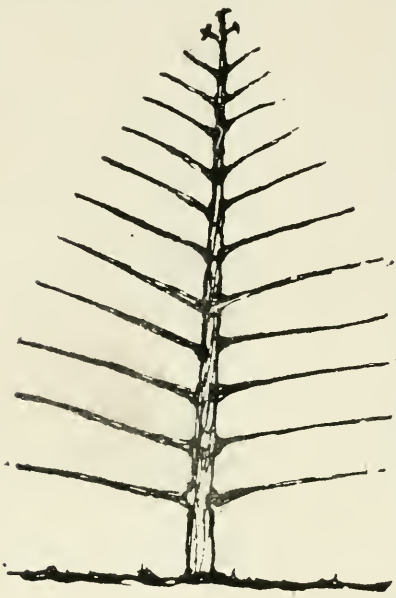
A counsel of perfection would possibly urge that the young trees be allowed to bear no crop at all until the fourth year, but the planter can very seldom afford to wait so long for any return; nevertheless he should watch his trees very carefully, and, if they are not very sturdy indeed, he should at least partially disbud them, only leaving a small amount of crop on the stronger wood.

CAPPING AND TOPPING.

Coffee trees are generally "capped" once or twice in the course of their growth, in order to strengthen the stem and primaries below the capping. Although temporarily it reduces the size of the tree, the benefits of this 'set-back' will be reaped later on in the increased crop-bearing capabilities of this strengthened wood.

The final process, when the trees are to be stopped at the maximum height required, is called 'topping.' In capping the stem of the tree is cut through at the required height with a

sharp knife drawn upwards and towards the body. The tree is then allowed to sucker and the one or two suckers required, according to which system is being used, are selected generally from the highest remaining stem 'bud' i.e. just below the highest remaining pair of primaries. This sucker then becomes the stem of the tree and in its turn is either capped again or topped as desired.



In the case of topping, the stem should be cut through a little above the desired height and the next two primaries should be cut short just before the first 'bud,' thus leaving short green stumps. By this means the small remaining piece of the stem will not die back, thus injuring the head of the tree as often happens where only the ordinary cut is made.

CHAPTER VI.

ON SHADE.

DESCRIPTION.

Coffee does not require densely shading. If this is done, the trees certainly grow well and look healthy and dark-coloured, but the yield will be very small and the growth of wood long and whippy. The aim of the planter in shading his coffee must be to produce with the fewest possible number of trees to the acre a curtain of light, even shade, which will break up the steady glare of the sun's rays and diffuse a dappled light upon the coffee. Consequently trees with small leaves are desirable.

The tendency of unshaded coffee is to crop in cycles of a large crop followed by a small one.

It is not claimed for shading that this tendency will be entirely eradicated, but that the shade will undoubedly have the effect of lessening the extremes and so producing more even crops to the good of the trees, while yet maintaining a high yield.

The main points in favour of shading, therefore, are:—

1.—The lessening of the extreme tendency to produce bumper and small crops alternately and so giving a more even yield.

2.—The conservation of moisture in the soil during droughty periods through less evaporation.

3.—Lessening the extremes of temperature as between day and night.

4.—Replacement of a valuable humus through the mulch of leaves shed by the shade trees, the materials for which are mostly drawn from a generally lower level than is attained by the coffee roots.

It will readily be admitted that, if the above qualities are correct, the coffee trees will be kept in a healthier condition and their longevity will probably be increased. The stems and roots of the shade trees will also to a small extent stop wash of the surface soil.

An important point in shading is the intermingling of different varieties. Mix trees of different varieties as much as possible in the planting, so that, when they have attained to their full size, each tree will have other varieties as its immediate neighbours.

Thus the danger of a disease or a parasite suddenly destroying all the shade (if of one kind only) on an estate will be avoided.

Also, when one variety of tree is out of leaf, it's neighbour will probably be in full leaf: thus large areas will not be entirely defoliated during certain seasons of the year.

Shade trees require pruning to a certain extent in order to get the maximum benefit and this should be begun early, when the trees are easily handled and shaped.

Once the trees are allowed to get out of hand the resulting labour necessary to get them into shape again—even if this be possible—will be expensive and a certain amount of damage to the coffee will be caused by falling branches.

There are two types of shade trees, the Temporary and the Permanent; the qualities of the two types not as a rule being combined in any one tree.

If possible the shade trees of both types should be planted about the same time as the coffee or even better still before it.

They should be planted in the same lines as the coffee, i.e. east and west, so that the maximum amount of shade will be concentrated on the coffee when the shade trees are still young. They should also be planted between the coffee trees and not in place of them, thus retaining the full number of coffee trees to the acre.

Complete cultivation is still possible for a considerable time and, even later on, cultivation one way is entirely unobstructed while a certain amount can still be done in the lines in which the shade trees are planted. This slightly increased difficulty of cultivation will be much more than equalised by the deterrent effect on weeds of the shade itself. The usual practice in planting out shade is to alternate the temporary and permanent types in such a manner that the temporary may be cut out gradually, as the permanent grow so that, when this is finally completed, the permanent trees will be at such distances apart as to effectually cover the ground without overcrowding.

Of course this cannot be done exactly and it is better to have to cut out a little, where the shade is becoming too thick, rather than to have to start planting up new shade trees when the coffee is fully grown.

QUALITIES OF TEMPORARY SHADE TREES.

The main qualities which the temporary type of shade tree must possess are:—

1.—Rapidity of growth.

2.—Not too deciduous a habit, since the greater portion of the shade for the first few years must be given by the temporary type.

On account of the essential quality of this type, viz: rapidity of growth, they are ipso facto surface feeders and in consequence are in many cases injurious to coffee, when they have attained any

considerable size for the reason that their roots enter into competition with those of the coffee. Therefore, directly the permanent type begin to spread and give shade the temporary should be cut out.

SPECIES OF TEMPORARY SHADE TREES.

The following are some trees of this type, which are obtainable either locally or from other countries, from which the planter may make his selection:—

Makinduri: (Croton Elliotanus) Indigenous. Grows very rapidly and germinates freely from seed. Nice foliage and spreading habit, when given plenty of room. Seed should be planted at stake. Common all over Ukamba Province and to be found in many other districts. Grows into a large tall tree.

Sesbania: from Kaimosi District: Indigenous, but there are several varieties, of which one is good. This grows very freely in the Kakamega district; attains a height of some 15 feet and is used by the natives to protect their crops from hail on account of the large amount of twig. Foliage light and sensitive. A prodigiously fast grower from seed, which can be planted at stake or transplanted from beds. Probably a short lived tree and is therefore not recommended as a permanent type.

Calpurnia Aurea: Indigenous. An erect shrub 10 to 15 feet in height with slender, grey, silky branches. A fast grower, which is very common in the Thika and Nyeri Districts.

Erythrina Lithosperma. Not indigenous. Seed not obtainable locally but could be imported. Growth from seeds is slow, but once the tree has produced mature wood, cuttings from this grow at a prodigious rate. Consequently this is very valuable for stakes of several feet in length may be planted, from which overhead shade will be obtained within a year probably in this country. In 18 months or so cuttings could be taken from these stakes and so on multiplying indefinitely. In Java this species is largely used as a permanent shade, but in S. India as a temporary shade only, being cut out when it attains to a fair size. Young trees are already being grown successfully in Kenya.

Mwangwa. Indigenous. Fast grower, but deciduous. Light shade. The wood is hard and is a useful material for estate tool handles. It will probably grow best in rainy districts; seed obtainable locally.

Mahutu (Kavirondo) or **Mahuru** (Meru) (Nitex Kenyensis) Indigenous. Fast grower, but of very branching habit and consequently requires much pruning. Light foliage. Seed obtainable locally.

Machaerium Tipa. Not indigenous. Fast grower with light foliage. Will probably be most suitable in altitudes under 6,000 feet Seed obtainable from the Forest Department.

QUALITIES OF PERMANENT SHADE TREES.

The qualities required in permanent shade trees for coffee are as follows:—

1.—A wide-spreading canopy habit, so as to cover the maximum area per tree.

2.—A deep-feeding root system, which will enter into competition with the coffee as little as possible.

3.—Light foliage.

4.—Rapidity of growth.

5.— Longevity.

6.—High manurial value of mulch.

7.—High commercial value of timber.

Trees of the permanent type, which are otherwise possessed of the requisite qualities, will frequently be of slow growth; hence the necessity of the temporary type.

The pruning of the permanent trees must be done with care and foresight from the beginning, in order to get as much shade as possible from each individual tree and to save unnecessary labour later on.

SPECIES OF PERMANENT SHADE TREES.

The compilation of a list of trees suitable for planting as Permanent Shade in Kenya must of necessity be largely conjectural. A real and general realisation of the necessity for shading the coffee in this country being of such recent birth, there is but very scanty information, which can be backed by proofs. Also the climatic conditions vary to a considerable extent in the different districts and, until a variety of trees have been tested and proved in the several localities, it will be quite impossible to give definitely a list of the most suitable trees. There are, however, a number of indigenous trees, which have been left in the coffee here and there in different states and from these certain general deductions can be made. Also there are certain indigenous trees, which admirably fulfill the required conditions though as yet they remain to be proved. Finally there are trees of proved value in other coffee growing countries, which may be of great value here also, if they can be introduced and grown successfully.

Mukuyu—Indigenous: A species of fig having a very fine spreading habit. The best known so far of the many varieties of fig trees that are indigenous in Kenya. Good mulch. Propagates from seed and probably in some districts from cuttings. Seed easily obtainable.

Albizzia Moluccana—Not indigenous: but now growing largely in Uganda and occasionally in Kenya. Fast grower. Light foliage and good spread. Largely used in Java as shade for coffee. The leaves of this tree close at night thereby permitting a freer circulation of air. The wood is useless. Seed obtainable from Uganda or from Nairobi firms.

Albizzia Stipulata: Similar to the above, but usually a slower grower with tougher wood.

Grevillea Robusta (The Silver Oak). Not indigenous, but largely grown in many districts. Fast growing. Although not of spreading habit, this tree is very useful for interspersing amongst other shade. Foliage light and mulch very valuable. The timber from big trees is of some value in districts where the growth is not excessively rapid. Saplings are used for poles for huts, etc. Seed obtainable almost anywhere as the trees seed freely.

Mungumu:—Indigenous. A fig tree somewhat similar to the Mukuyu. Propagated from cuttings. Nearly throughout Ukamba Province.

Cedrella Toona: Not indigenous. Fast grower with a good spreading habit. Has the disadvantage of being surface-rooted. Light foliage. Seed obtainable from Forest Department.

Mulalachi. Indigenous. Medium grower. Irregularly deciduous. Grows to a fine, spreading tree and gives a nice shade. Timber useful for motor car box-bodies. Seed obtainable from Forest Department or from Ngong district.

Pithecolobium Saman. Not indigenous. The Rain Tree of the West Indies. Type of foliage light, but the foliage is in such profusion in districts where the tree flourishes, that it would require thinning out. Grows excellently at Koru.

It must not be supposed that this is by any means a complete and comprehensive list, but from amongst the foregoing, together with what local information he can gather, the planter should be able to make a sufficient selection of 4 or 5 varieties suitable to his district.

A few other trees, which are as yet unproven in Kenya or remain in doubt are:—

Dalbergia Latifolia. The Indian Rosewood. The shade tree par excellence. Fairly fast grower of a leguminous family. Grows to a great size and has a magnificent spread of fine light foliage. Timber exceedingly valuable being the Rosewood or Blackwood of Commerce. Seed has arrived from Judea and may be obtained in small quantities from the Secretary of the Coffee Planters' Union.

Albizzia Odoratissima. A medium to fairly fast grower, having a good spread of light foliage. Experiments are being carried out with this tree.

Species of Terminalicie. Medium growers of spreading habit. Timber valuable in certain species.

Schinus Molle. The Pepper Tree. A rapid grower, which might be of use in districts where there is danger of hail.

PLAN OF SHADING.

The following plan is given as an indication of a suitable method of shading under average conditions. The spacing of coffee is taken to be 9ft. x 9ft.:—

The dots denote coffee trees.
T. denotes temporary shade tree.
P. denotes permanent shade tree.

Thus the spacing of the permanent shade trees is 45 feet x 28½ feet.

Well grown trees should cover the ground at this spacing under normal conditions and if here and there a gap appears probable, a Grevillea Robusta tree may be planted in the centre of the space.

PROTECTION OF PLANTS.

Another kind of shading which may be practised with advantage is the method of planting, say three plants of some quick growing leguminous species in close proximity to the coffee, to act as shade and protection combined. They will undoubtedly save the breaking of primaries through bad cultivation and will protect the coffee to a certain extent in case of hail. They will also be useful at higher altitudes where the growth of the coffee is slower by tending to draw the coffee up.

These plants may be left for 18 months—2 years before being taken out, but care should be taken that whilst shading and protecting the coffee plants they do not smother them.

Species suitable for use in this manner are some of the Crotalariae and Sesbania.

CHAPTER VII.

ON THE FUNGOUS DISEASES OF COFFEE.

GENERAL NOTES.

In this and the following chapter on the Insect Pests of coffee the intention has been to give as clear a description of and as much useful information as possible about not only the Diseases and Pests, that are well known at the present time, but also about those which are considered serious menaces to coffee in other countries and have either already been noted in Kenya or might very possibly arise in the future.

The attitude has been adopted, that, although such a formidable list might appear prejudicial to the interests of coffee growing in Kenya, yet it is better to be forewarned and that the best guarantee against any disease or pest becoming a serious danger is for every planter to be able to recognise it and to know the best means for combating it.

Confidence must be placed in the reader's sagacity to realise that all of the diseases and pests described are not serious menaces to coffee in general, and that many of them have not ever assumed that nature in Kenya; while also just such lists might be prepared of the known and possible enemies of coffee in any of the important coffee growing districts of the world.

Also account must be taken of the possibility that some change or inversion of natural conditions may quite suddenly turn some well known, but lightly regarded, disease or pest into a locally serious menace.

Before going into details of fungous diseases and their treatment, it is imperative that the planter should at this point fully grasp the fact that, if he tends his coffee carefully and keeps the trees in good heart, he will have advanced quite half way towards the combating of these diseases.

The order in which the diseases have been arranged in these two chapters may be taken as an indication of:—

1. The extent of their distribution.
2. Their importance as regards damage already caused in Kenya.
3. Their potentiality for damage, as shown by their records in other countries.

LEAF DISEASE.

Hemilia Vastatrix or Leaf Disease is perhaps the most widespread and pernicious fungous disease of coffee throughout the coffee growing districts of the East. It is even to be found on Wild Coffee growing in dense shade under its parent forest trees and there is probably no estate of "bearing" age in S. India or Kenya, where it cannot be found during some season of the year.

Consequently the degree rather than the fact of its presence should concern planters in Kenya and the seasonal increases and decreases should be watched closely and with foresight.

Leaf Disease under suitable conditions has been known to devastate whole districts and this disease was the main reason for the substitution of Tea for Coffee in Ceylon.

The first signs noticeable are bright yellow spots on the undersides of the leaves, most frequently starting on branches near the ground and in contact with weeds. These yellow spots enlarge rapidly and the centre turns to a reddish brown with an orange-yellow powder surrounding it.

Infection is spread by means of this powder being carried by any motive force and transferred to another leaf or tree. The spores require a damp atmosphere for development such as is to be found on the underside of leaves in showery, misty weather and they cannot develop in a dry atmosphere.

Excessive heat or extreme cold kill the spores, which germinate rapidly and vigorously at a temperature of about 75deg. Fahr.

The action of this disease is the germination of the spores which send tubes into the cells of the leaves. These structures affect the leaf cells and produce the disease spots, which spread in extent until finally the affected leaves drop off.

Thus in cases of bad attacks the coffee trees may be largely defoliated and will in consequence be unable to ripen their crop.

The three main remedies are:—

1. Good cultivation—in the wider sense.
2. Good pruning.
3. Spraying.

Although the first two are of very great importance in minimising the damage they are not entire preventatives nor will they eradicate the disease.

Spraying is a necessity where the coffee is liable to bad attacks, not only for the safety of the individual but for that of his neighbours.

Three useful sprays are:—

1. Bordeaux Mixture.

2. Carbide Mixture.

3. Harbas Mixture.

BORDEAUX MIXTURE.

A simple method of making this mixture is to dissolve Copper Sulphate (Bluestone) in cold water at the ratio of 2lbs. to every 40 gallons.

If the Copper Sulphate is pounded up it will dissolve more readily.

Add clean, sieved Lime until a neutral solution is obtained. The rough and ready test to determine when the solution is neutral is to dip a clean bright knife-blade into the mixture.

If copper is deposited (i.e., if the blade tarnishes) add more Lime until the steel remains clean and bright. Lime varies so much in quality that the weight necessary to neutralise 2lbs. of copper sulphate may very considerably. The Planter may, however, start with 4lbs. and add more by degrees.

This mixture should not be prepared or left in an ordinary iron receptacle, as the iron will be gradually eaten away.

The mixture should be thoroughly strained before being poured into the sprayers.

As regards spraying, the greater the contents of the sprayer the cheaper the work will be over considerable areas, i.e., portable tank sprayers will work more cheaply than knapsack sprayers and co-operatively owned power spraying plant would without doubt be the cheapest over all in the long run.

Double nozzles—one set to point straight forward and one turned upwards at an angle of about 30deg.—will be found the most satisfactory and efficient.

They should be well worked round inside the trees so that the undersides of the leaves are wetted by the spray.

The nozzles should be as fine as possible and a good pressure should be kept up within the sprayer, in order that the most efficient work shall be done with the least amount of material. Reamers for cleaning out the nozzles should be kept handy.

The planter should personally supervise the cleaning and oiling of the sprayers previous to being put away after use or before being used for spraying with other materials.

An area should be sprayed twice in order to get the best results; once when the foliage is old, i.e., fully grown and again when a new flush of leaf is but partially grown. In the latter case care must be exercised to avoid the mixture being over strength—in fact three-quarter strength will be probably sufficient for a second spraying when there is a flush of young leaves—as some burning of the new leaf may result.

The above, of course, only applies when spraying is done regularly as a part of the general care of the coffee. When a bad attack of leaf disease is experienced the spraying must be done at once, whatever stage the coffee trees are in.

It may perhaps be of interest to detail the process and result of some experiments on spraying coffee with Bordeaux

Mixture, which the author conducted some years ago in S. India. The time chosen was when the young berries had just begun to swell.

EXPERIMENTS WITH BORDEAUX MIXTURE.

Several blocks of equal area were selected in different parts of the estate and in pairs with one block on each side of the road or path. They were chosen to approximate as nearly as possible —each block to its partner—in age, size, condition of trees and the amount of crop. One of each pair of blocks was twice sprayed with Bordeaux Mixture and the other left unsprayed.

The blocks were compared for:—

a. Appearance.
b. Ability to bear their crop.
c. Proportion of the crop borne in
(1) Cherry (2) Green (3) Light (Buni).

The blocks were continually swept clean and any fallen berries tabulated and set aside.

The blocks were then stripped completely of crop on a certain day in order to work out the results of (c).

The cherry, green and buni from each block was then mixed up and the total crop from each block was dried separately and cleaned by hand. The clean coffee was then measured and weighed.

The following results were obtained:—

a. The appearance of the sprayed blocks was infinitely healthier than the unsprayed.
b. The sprayed blocks bore their crop much better.
c. The proportion of cherry was very considerably higher and there was less buni in the case of sprayed blocks.

This shows that the sprayed trees developed their crop more fully and ripened it earlier.

Also in every case the sprayed blocks produced more clean coffee than the unsprayed and in every case except one—in which the figures were approximately equal—the specific gravity of the clean coffee from the sprayed blocks was slightly higher than that from the unsprayed.

Almost a year after spraying the blocks were examined again. The Planting Expert saw one or two of the blocks in question and traces of the spray were still visible on the leaves, although some 100 inches of rain had fallen meanwhile.

In every case the sprayed blocks were in a much healthier condition than the unsprayed. The coffee treated was anything from 15 to 40 years old and was planted about 5 feet x 5 feet and grown under shade.

Unfortunately since this experiment was only carried out in the one year, nothing can be definitely claimed to have been proved, but the results obtained give very strong indication, that not only will regular sprayings benefit the health and vitality of the trees, but will even directly affect the quality of a single crop.

CARBIDE MIXTURE.

This mixture acts in much the same manner as Bordeaux Mixture and is also an effective remedy.

The constituents are 2lbs. Copper Sulphate (Bluestone) and 12 ozs Calcium Carbide to 40 gallons water. A neutral solution is made in the same manner as before.

The process of mixing in the case of this spray should be done in the open as poisonous Acetylene Gas is given off.

HARBAS MIXTURE.

The third efficient remedy is Harbas Mixture. This can be bought ready made in tins, the contents only requiring to be diluted with water, thus saving the planter the trouble of mixing.

Whether the planter uses one or another of the above mixtures is immaterial for all are effective, the great point is that steps shall be taken to combat Leaf Disease regularly when observed and, if this leads to the adoption of spraying as a regular item of intensive cultivation for the good of the coffee, then the planters of Kenya Colony will have taken a great stride in the right direction.

DIE BACK.

This disease is common especially in districts having a low rainfall: where coffee crops very heavily or is neglected and as a consequence of droughts.

It is of importance in that it causes considerable loss of crop, damage to trees and detraction from the appearance of the estate.

There is no definite disease that is known to produce the effect of this die back, but on wood thus affected there is commonly to be found a fungus called Phoma.

This certainly has the effect of increasing the die back, but it has not been proved that the actual root of the trouble can be attributed to the Phoma or any other fungus.

Probably the origin of the disease lies in the weakened condition of the coffee trees from such causes as over-cropping, drought, previous bad attacks of leaf disease or Thrips or bad planting having caused damage to the root system.

Branches begin to die back from the tips and the fungi are thus enabled to invade the already diseased wood and so aggravate the damage.

Directly die-back is observed the infected branches should be cut well back from the diseased parts. If the wood shows at all brown and dry looking in the centre when cut, it means that the disease has penetrated to this point at least, and the branch must be cut back still further until the wood shows white and full.

The trimmings thus cut off should be collected, carried to the nearest convenient spot and burned. Careful search should be made for an explanation of the lack of vitality in the trees of the affected area and steps should be taken to remedy the primary cause of the disease by spraying, manuring cultivating, etc., for the only real preventative and cure combined for this disease is to keep the trees in good heart.

BROWN EYE SPOT.

Brown Eye Spot (Cercospora Coffeicola) is a fungus disease which, although being fairly widely distributed, is not very well known, as it has hitherto done little harm in Kenya.

The spores of this fungus enter the tissues of either leaves or green berries and cause pale round spots on the former while the latter are badly attacked, turn black and shrivel and in mild cases the beans become marked with a consequent lowering of market value.

In cases of bad attacks spraying with Bordeaux, Carbide, or Harbas Mixtures, will prove effective.

SOOTY MOULD OR BLACK BLIGHT.

This cannot reasonably be termed a fungus disease on coffee, since it depends entirely on the excreta of Scale Insects for its means of existence and extracts no nourishment whatever from the coffee.

The only damage done is the impeding of the leaves from performing their duties effectually by covering them with a sooty mould.

Measures taken against the scale Insects will therefore be measures taken against this also.

STUMP ROT.

Stump Rot or Root Disease is not at present very common in Kenya, nor is it likely to do great damage since the open and friable texture of most of the coffee soils in Kenya is unsuitable. In stiffer soils such as the Laterite Clay of large districts in S. India the coffee trees suffer considerably from Stump Rot, where the decaying roots of shade or forest trees are present in the ground.

Coffee trees affected by Stump Rot turn yellow and wilt considerably.

Both coffee tree and stump should be taken out if possible and burned, as a coffee tree once at all seriously affected wi never be a really productive tree agani.

If a tree is seen in such a condition as this, the planter should search round about for the remains of an old tree stump, the presence of which will enable him to make a probably accurate diagnosis of the complaint from which the tree is suffering.

Should the stump be very large a trench of one foot wide by two feet deep should be dug as close round the stump as possible, so as to obviate the stump and its roots from the possibility of spreading further infection. Another trench should also be dug to enclose a reasonable area, for the prevention of the spread of infection in case the affected coffee tree or trees should have passed the infection on to yet other trees. The soil that is taken out from these trenches should always be thrown "within" the enclosed area.

This area should then be well dug or forked over and any roots or trees encountered taken out and a thorough liming at the rate of 1 ton per acre should be given.

Stump Rot is sometimes met with in Nurseries when the roots of a young plant come in contact with a decaying stick.

If a drooping plant is pulled up and the roots are found to be decaying and speckled with a white fungus, the ground round about should be thoroughly broken up, the source of infection removed and a little time applied to the neighbouring plants.

CHAPTER VIII.

ON THE INSECT PESTS OF COFFEE.

GENERAL NOTES.

There are very many insects, caterpillars,etc., that either habitually live on coffee or are quite able to assimilate it and thrive thereon, when their own natural food fails.

The pests that are described in this chapter, are therefore only those that stand out pre-eminently by reason of the amount of damage that they cause habitually.

Nevertheless, a good planter will be continually on the look-out for signs of any other habitue of the coffee becoming a pest locally.

An instance of this is supplied by the Parasa (the Stinging Caterpillar).

This had long been known to be a coffee-eater upon occasion, but had not given cause for its consideration as a serious pest. Yet through some inversion or failure of its natural conditions, it suddenly assumed the character of a very serious pest in somewhat restricted localities.

THRIPS.

(Diarthrothrips Coffeae.)

This is a comparatively active, tiny, white insect. The female lays her eggs in the tissues of the coffee anywhere on leaves berries or green shoots. The eggs hatch out and the young thrips burrow into the tissues and absorb the plant juices.

Leaves will be observed to have a silvery appearance caused by the numerous white veins left in the wake of the thrips, the result being that the leaves are deprived of the necessary sap, cease functioning and finally drop off.

Green berries which have been badly attacked turn black and do not develop.

Considerable areas may be almost entirely defoliated and denuded of crop, and the vitality of the trees being thus lowered they are laid open to the attacks of fungi such as Phoma.

The thrips require dry sheltered conditions and thrives in dry sheltered hollows, on slopes that are not open to the prevailing winds and in the still, airless spaces where wind breaks or buildings are close to the coffee.

The first signs of an outbreak will generally be found in some such area as one of these, and not only of thrips but of almost all the ills that coffee is heir to.

Scientific observation of thrips has been attempted by experimenting in the Insectary and by enclosing trees in the estate, but without success, as the insects will not live under cover.

All information concerning this pest has of necessity been collected by observations in the field.

Thrips, therefore, requires dry and sheltered conditions, but without actual shade and the direct opposite rain, wind and shade; are found to be destructive to it.

Here, then, is a very strong argument in favour of two of the most important points in coffee planting in Kenya, viz:—

(1). The shading of coffee.

(2). Exposure to the beneficial effects of the prevailing wind, though the coffee trees must be protected from the actual force of these winds.

Rain is not within the control of the planter, but he may give to his coffee trees the beneficial effects of a good air circulation and something of their natural environment by means of shade.

As regards treatment for an outbreak of thrips.

Spraying with Bordeaux Mixture is not efficacious, for although it is a deterrent in that the Thrips will not live and thrive on leaves treated with this mixture, yet it will not actually destroy them.

SOAP SOLUTION.

The simplest remedy, and a fairly effective one, is to spray with a solution made up by dissolving one bar of Sunlight Soap in five gallons of water. This is probably the best remedy for a small outbreak.

NICOTINE SULPHATE.

The future of combating pest outbreaks in highly and widely developed coffee districts appears to be in the direction of co-operative organization, and in dusting as against spraying.

The dusting process is apparently rapidly taking the place of spraying in America and is being introduced into England, as it is considerably more rapid in operation and the difficulty of water transport is avoided.

Nicotine Sulphate applied in this manner is a powerful insecticide and is very efficacious against thrips.

The Nicotine Sulphate is purchased in a finely divided powder, and is then mixed with a distributing base such as lime which must, also be very finely divided.

This mixing may be done on the estate or the ready prepared dust may be procured.

This dust may be applied either by means of a power plant for large areas or by any of the ordinary hand sprayers, a long funnel being substituted for the nozzle.

In the case of Nicotine Sulphate, the Nicotine gradually volatilises and is a powerful insecticide, while the lime, having performed its task of evenly distributing the former, falls to the ground, where it supplies a very necessary ingredient to the soil.

In cases where an attack of Thrips is so bad as to necessitate cutting back the trees, or where the area affected is very limited and where spraying materials are not readily available, so that pruning back is the easiest and cheapest remedy, these prunings should be burned at once, as the Thrips are able to stay on the dead leaves.

It has recently been discovered that Thrips during wet weather take shelter in the burrows in the leaves made by the larvae of the Leaf Miner Moth. Destruction of this moth will therefore deprive the Thrips of a refuge from weather conditions, which ordinarily are fatal to them.

THE COFFEE BUG.

The Coffee Bug (Antestia Lineaticollis) is a very serious pest in many districts and causes much actual loss of crop and increase of labour by the nature of the damage done to the coffee trees.

Its distribution in Kenya is fairly wide and it will not improbably become general.

It is of the natural fauna of the country, since it was observed on native crops such as Matama and Wembi before the cultivation of coffee was started, though since then it appears to have adopted coffee as its chief food.

This fact militates rather seriously against the possibility of eradicating the pest completely.

Antestia is a particularly good example of Nature's pendulum.

The Bug suddenly appears in large numbers in some districts. These in time lay their eggs. This is the opportunity of their parasites, the Chalcid Flies, which proceed to parasitise many of their eggs.

The planter hastens the cycle by destroying the bugs that hatch out, while the parasites go free.

The next stage is that the Antestia has been so decimated that it is no longer to be noticed.

The swarms of parasites, having no host, die out; and the bugs are gradually enabled to increase again until another outbreak occurs.

The most effectual remedy, assuming the impossibility of entirely eradicating this pest, appears to be for the Entomological Department to keep in stock a very large number of parasites,

which could be distributed when required. This would be quite feasible and thus outbreaks of Antestia could be largely checked by those planters whose careful observations enabled them to see that the pest was on the increase.

The eggs, which are white in colour and slightly oblong in shape, are laid in clusters of about twelve—each egg standing erect.

They are usually laid on the underside of the leaves, but may also be found on berries, stems, dry leaves, and even on twigs and stones underneath the coffee trees.

The duration of the egg stage is from one to two weeks, the young nymphs then emerging.

A properly hatched egg has a neat cap which opens at the top of the egg to allow of the nymph's exit.

The nymphs when hatched are similar to the adults, but very much smaller and wingless. They change their skins, or moult, five times—becoming larger in each stage—until at the fifth moult they are equipped with wings and become fully adult.

Each of these five stages may be said roughly to occupy from two to three weeks according to the season of the year; so that from the time the eggs are laid, until the bugs arrive at maturity, will be from three to four months.

The female deposits on an average about a hundred and twentyfive eggs.

The adult life of a male Antestia is computed at a hundred and six days, and that of a female at a hundred and thirty-one days.

Therefore an average life cycle may be given as from seven to eight months.

Considering that during the whole of this period, except for about the first three or four weeks in the egg and the first nymphal stage, the bug is a voracious feeder, the amount of damage that each individual bug may do can be easily realised.

Conversely, the planter has a considerable length of time in which to destroy the bugs before they reach the adult stage.

The adult bug is about the size and style of a fairly large lady-bird with orange and white markings on a ground colour of greenish-black or dark brown.

The bugs are especially active in bright sunshiny weather and less so when the weather is dull and clouded, and in the mornings and evenings.

The damage is caused by the insertion of a proboscis into the green berry or shoot, through which the plant juices are absorbed, the result being that the bean when prepared is badly spotted and so greatly reduced in value.

The green berries are usually attacked first and damaged or even killed. The green shoots and buds afterwards.

The irritation in the latter cases consequent upon the puncture, results in an aggravated flush of leaf.

This not only reduces the number of flower buds, but also renders the task of getting the trees back to normal very heavy

indeed. It may be even be found advisable to cut back badly damaged branches to the first undamaged bud or joint, instead of endeavouring to remove all the superflous shoots by hand. Either way means considerable expense in labour and loss in time and crop.

The nature of the Antestia renders spraying so inefficient as to be practically useless and resort must be had to other means of destroying it.

The bugs themselves may be collected by hand: children are very quick at catching them.

It is advisable that the planter should provide each child with a tin having a little water or kerosene oil in it, and see that in the evening each child has caught a reasonable number of bugs and then personally superintend the burning of the day's catch. Otherwise the same lot of bugs will do duty for several days while the children spend their time at their ease in the coffee.

While the above method is suitable for destroying the bugs after an outbreak has occurred, the Chalcid Parasites are Nature's own means for controlling them.

The following is quoted from the Bulletin on the Coffee Bug issued by the Division of Entomology:—

"The female (Chalcid Parasite) inserts her ovipositor into the egg of the bug and deposits an egg. This egg hatches and the young grub feeds on the contents of the bug egg, completes its development within the egg shell, and finally breaks its way out a fully developed minute wasp. Eggs, which have been parasitised in this way, are easily distinguished as.....they begin to turn blueish grey in colour. This colour is invariably characteristic of parasitised eggs."

The planter can therefore help nature (up to a point) by making collections of Antestia egg clusters whether white or blue.

These should be put into a box into one side of which a glass tube is inserted. The parasites will hatch out first, will be attracted to the light and so will be found in the tube. They may then be liberated in the coffee and any bugs that may hatch out subsequently may be killed.

Above all the planter should not destroy Antestia eggs indiscriminately, whenever they are observed, as by so doing, he will probably destroy more parasites than bugs, since many of the white eggs found may have been parasitised but not have had time to change colour.

It is better to let Nature's plans work out as far as possible in the natural manner, the planter merely assisting by providing the conditions most advantageous to the parasite at the expense of the bug.

THE CUT-WORM.

Some description of the Cut-Worm (Prodenia Litura) and methods for its control has already been given in Chapter V.

The Larvae usually attack young plants only and the coffee trees are as a rule safe from their depredations after the bearing stage has been reached.

Th nature of the damage caused is the complete cutting away of the soft juicy part of the stem of the young plant just below the surface of the ground, thus causing an injury from which there is no chance of recovery.

When a plant has been cut, the foliage droops and turns yellow and such plants may be pulled up at once as they will die.

If the earth is scraped away carefully from close around a cut plant, the Cut-Worm may often be found just below the surface.

It is an ugly black caterpillar-like Larva about one to one and a half inches long and should be hunted out and destroyed whenever possible.

Great damage may be caused by this pest in weedy and dirty ground, such as may be found after a catch crop of beans, when the soil has not been thoroughly cleared up.

The great preventive against this pest is to keep the estate as clean as possible.

In districts where the cut-worm is prevalent the coffee plant should also be protected by shields made from the dried stem of bananas or some stiff paper treated with preservatives.

These are tied or clipped in a cylinder round the stems of the coffee plants, but not very close, and should reach from 1½ to 2 inches below ground to from 3 to 4 inches above.

The former are very easy and inexpensive to make, but would probably have to be renewed at least twice before the coffee could be considered safe, while the latter—although comparatively expensive—will last for three years in the ground.

At the same time as these shields are applied the same boys very often put down a poison for the cut-worm in the shape of Paris Green (Copper Arsenate.) A tea cup of this poison is mixed thoroughly into a load of crushed maize of medium coarseness and a small handful of this is placed in a ring a few inches away from each coffee plant and lightly covered with earth. The Cut-Worm eats the maize before reaching the plant and is poisoned by the Paris Green.

There is another Cut-Worm (Plusia Orishalcea) which is similar in habit to the first mentioned and which may be treated in the same manner.

THE CLIMBING CUT-WORM which fortunately is not common is exceedingly difficult of treatment, as it climbs up into the branches, which it proceeds to cut in the same manner as the stems are cut by other cut worms.

It would seem that the only method possible of employment is hand picking, whenever the whereabouts of this pest is betrayed by the wilting of the branches that have been cut.

LEAF MINER MOTH.

Cemiostoma Coffeellum in some countries known as Fly is a tiny white moth, which is a very serious pest in Brazil and is common all down the Atlantic Coast of South America and in the West Indies. It has also been recorded from Ceylon.

In Kenya it is probably fairly widely distributed and on a few estates has caused appreciable damage, but as a general rule it has not as yet proved to be a very serious pest.

Its record in S. America however shows that it should not be disregarded and all reasonable steps should be taken to destroy it.

The eggs, which are minute, are laid along the veins on the upper sides of the coffee leaves. The Larvae hatch out and burrow into the leaf tissues in all directions causing discoloured blotches, which injure and even kill the leaves. These Larvae purpate in white silkin cocoons on the under surfaces and near the edges.

The female is said to lay about 20 eggs the greater number of which hatch out, and the life cycle is probably about 5 to 6 weeks.

The minute size of the moth and the habit of the larva of feeding between the cuticles of the leaves render it immune from such remedies as spraying.

It is, however, very susceptible to the effects of smoke from ordinary grass or wood fires, by which it may be driven off and even destroyed.

It has natural enemies in the shape of Insectivorous Birds and Parasites, of which latter five species are already known.

Since the young and delicate leaves are preferred and the blotches are very easily distinguishable it might be feasible, in case of an outbreak, to drive away or destroy the moths by lighting fires upwind of the affected area, and then to pick off the damaged leaves and burn them.

THE STINGING CATERPILLAR.

The moth Parasa Vivida or the Stinging Caterpillar is a member of a large family, of which several units are sometimes found on coffee. Some of these, as in the present instance, are furnished with stinging spines while others are spineless and resemble "Jujubes" more than caterpillars.

The Stinging Caterpillar was not previously reckoned as a serious pest, but, owing to some failure or inversion of it's natural conditions, it suddenly became a very serious pest indeed chiefly in the Kyambu and Ruiru districts.

The usual food of the caterpillar is the Castor Oil plant and a possible explanation of the sudden outbreak may be in the fact, that in the previous season much of the Castor Oil had died down in these areas.

The Caterpillar has long been known to be an occasional coffee eater so that coffee appears to be an alternative food in the case of a dearth of its natural food the Castor Oil plant.

The moth is of moderate size, brown and green in colour, and is a fast and ordinarily a night flyer.

The eggs are laid in flat clusters, as a rule on the Castor Oil leaves, but when laid on coffee leaves they look like a thickening of the cuticle and are very difficult to find.

The tiny caterpillars hatch out and begin by eating the leaf tissues close to the eggs, after a while moving away to the edges of the leaves.

Even the smallest caterpillars are able to give a sharp sting, if the back of the hand is brushed over them.

They grow rapidly into fat semi-translucent, light green coloured caterpillars and have a formidable array of spines along the back.

These caterpillars pupate in hard dark-coloured cocoons, which are generally placed in the crutch of two branches, on the stem of the tree or on the undersides of the primaries. They are not easily distinguished although the cocoons are of a considerable size. The cocoon has a neat round lid through which the moth forces its way.

The first indication of the presence of these caterpillars will be the stinging of the labourers as they work in the coffee. They feed voraciously and when a tree is badly infected with them, the droppings make a distinct pattering sound on the leaves beneath the tree which appear to have been lightly sprinkled with soot.

The damage caused is the consumption of the leaves of the coffee by the caterpillars and consequently in bad attacks crop on the affected area is altogether lost, since no leaf may be left wherewith to ripen it.

In case of such an outbreak the first step to be taken is to cultivate thoroughly in such a manner as to isolate each individual tree over an area calculated to contain all the affected trees.

This step will prevent the caterpillars spreading from one tree, when finished, to another, since they are unable to negotiate the rough crumbling soil and die in large numbers in the furrows.

This, therefore, confines the caterpillars to the separate trees which must be dealt with individually.

Spraying with Arsenate of Lead poisons those caterpillars that continue eating, but there still remain those that have already

pupated are sufficiently developed to pupate when the spray is applied. Search must therefore be made for the cocoons.

The Parasa has natural parasitic enemies, which are probably sufficient as a rule to keep it in subjection.

The final destructive factor in the case of the outbreak mentioned was the ensuing drought.

The coffee trees did not put out any new leaf and the caterpillars of the next hatch were unable to consume the old stale leaves, which perhaps still had traces of the spray on them and were either poisoned or starved.

SCALE INSECTS.

This is a numerous class, of which several species are to be found on coffee, citrus and other fruit trees.

None of these appear to have done much damage in Kenya up to the present time.

Undoubtedly the best guarantee against serious damage by Scale Insects is keeping the coffee trees in good heart. Lecanium, Africanum being practically indentical with Lecanium Viride has however potentialities for grave harm to coffee. It appears to be distributed widely over Kenya, but it is usually found only on plants and young trees, the growth of which they doubtless affect to some extent.

The small scale is able to move about but it soon finds a suitable feeding ground and thrusts a proposcis—through which it sucks the plant juices—into the tissues of the leaf, berry or green wood. If undisturbed the scale grows and loses the use of its legs.

The eggs are laid "in situ" and the female dies, her body or shell forming a covering for some hundreds of these eggs.

The females are able to lay fertile eggs parthenogenetically, i.e. without necessity for mating with the male, for many generations and almost all the eggs are therefore females.

Lecanium Africanum is a small flat, slightly oval shaped light green insect with a wavy black line like a hair pin on its back. The leaves of the coffee beneath the feeding scales become covered with the excreta, on which grows a black fungus. It is from this cause that the name Black Blight is sometimes given to this scale.

These scales are regularly tended by many kinds of ants, which protect them. Consequently, should a bad attack of the scale be experienced, measures must also be taken to destroy any ants' nests in the neighbourhood. Their natural enemies are limited. They are parasitised to a very small extent and occasionally Lady-Birds eat them.

The chief agent of destruction of the Lecanium Viride (and the same has been observed on Lecanium Africanum in Kenya)

is a white cotton wool-like fungus, which attacks the scales in continuously wet or damp weather and destroys them almost completely.

The infinitely small percentage which escape are, however, sufficient, owing to the short life cycle, parthogenesis and the number of eggs laid, to produce noticeable numbers in a very short while. Spraying is effective.

A useful spray is obtained by dissolving 4 lbs. soap, 1 lb. Salt Petre and 1 lb. Resin in forty gallons of water.

Another by making an infusion of Nicotine by steeping dried tobacco leaves in water. The strength required for efficiency in this case is a matter of test on the estate. Brushing with soap suds is a remedy where only very small patches are concerned.

For young plants the best method is to take a double handful of soap suds; stand above the infected plant and enclose the stem at the bottom with the hands full of suds. Then draw the hands slowly upwards, so that all the branches and leaves pass between the hands and are brought into contact with the suds.

If rain falls within a few hours the work will be rendered ineffective.

Lecanium Hemisphericum (the Brown Scale) and Pulvinaria Psidii which is a scale not very unlike L. Africanum but longer, larger and without the clearly defined mark on the back, are both found on coffee, citrus and guava and for this reason these latter trees should not be planted amongst the coffee or in the neighbourhood of nurseries. Neither of these two scales are very destructive.

Asterolecanium Coffee (the Pit-making Scale) which fortunately is not common, is exceedingly difficult to deal with and probably the wisest course is to cut off the badly affected wood and to burn it.

This scale is very hard, so that a contact spray is almost useless, and regularly encrusts a whole stem of coffee thus causing considerable hinderance to growth and may even kill the wood.

Pseudococcus Adonidum, the Mealy Scale or Mealy Bug, is also to be found on coffee in Kenya, but as yet has not done much damage .In some districts in other countries, however, it causes considerable loss, as it not only attacks the leaves and berries, but also the roots to a depth of sometimes 1 foot, below the surface.

This bug is covered with a kind of white fur, by which it may easily be observed and recognised. It prefers hot and dry conditions and will generally be found to disappear with the rains.

BORERS.

There are several species of Borers to be found in E. Africa, but hitherto only the Bean Borer (Stephanoderes Hampei) of Uganda has done extensive damage. This is also known as the Coffee Berry Beetle.

The eggs are laid on the half-formed berries and the larvae, when hatched, burrow into the tissues, where they mature and then burrow out again.

The effect of this is to mark and pit the beans, which are thus rendered practically valueless.

The only remedy at present appears to be the picking off and destroying of attacked berries whilst the larvae are still inside.

The following Stem Borers which are found in Kenya are fortunately not common, they are—Apate Monacha and Anthores Leuconotus.

The larvae enter the step or branches of the coffee trees and eating their way forward finally mature and immerge from other holes.

No preventive for these Stem Borers has yet been found and the only method that can be adopted to destroy them is to search out the immature Larvae, when their activities are betrayed by the wilting of the trees or branches and to kill them in their borings.

Dyrphia Usambica makes a series of small holes like shot holes right up a branch killing it very effectively.

There is no better remedy for this Borer than for the Stem Borer.

CHAPTER IX.

ON PERSONAL ADVICE AND BOOKS.

ADVICE TO YOUNG PLANTERS.

It is hoped that the following advice, which is primarily intended for the young man just out from home for the first time will not be taken amiss by those, who, although having had no previous experience of planting coffee, may yet have spent many years in the East.

The first two pieces of advice may seem to be beyond the province of this book altogether and yet they are so important in the case of young men fresh to the East that they will be given precedence of all others. They are:—

1.—Always wear a topee or a safe double terai when out of doors between the hours, say of 7 a.m. and 4 p.m.

2.—Do not drink alcohol before the heat of the day is well passed.

The young planter, particularly when learning his work, will be out of doors for a great part of the day and will be in consequence continually exposed to the action of the sun and he should take reasonable care, at any rate to start with, until he has had time to get somewhat acclimatized.

It is most advisable that he should wear either a red vest under his shirt or a shirt made of sun proof cloth, or else a spine pad to protect the spine between the shoulders and the small of the back. He should remember that the dull days are the most treacherous.

It is well worth taking some trouble to avoid a touch of the sun and besides, a young fellow, who succumbs to the sun before he has been out more than a few weeks or months is likely to lose considerably in health and in the estimation of old stagers.

Open wounds, such as cuts on the hand and sores should always be covered by a bandage as the rays of the sun in Kenya are detrimental to quick healing.

The young planter, who may very likely think that these precautions are rather needless for a strong, healthy man just out from home, should remember that, if he does go sick after a short while through neglect of some very ordinary precaution, he will only have himself to blame, and he will lose in reputation as a useful worker.

As regards abstention from alcohol:—Doubtless it is a good thing to be tee-total, but perhaps the very temperate man has the greater advantage as it is natural that a healthy man should need and benefit by a small stimulant after a hard days work. Another recommendation is to have something to eat besides the early morning cup of tea before going out, if an hour or so of work is to be done before breakfast.

GENERAL DESCRIPTION OF A PLANTER'S WORK.

The energetic planter who supervises the work of an estate in person must needs be somewhat of a handy man. Occasions arise when he may have to put his hand to the most unusual labour.

Besides his specialised knowledge of Coffee Planting an acquaintance with the following branches of science is occasionally extremely useful:—

General Agriculture, Botany, Entomology, Chemistry and Physics, Civil Engineering, Mechanics, Medicine and Veterinary.

In the acquirement of a rough working knowledge of the above there lies a danger for the young planter, who while picking up what practical knowledge he can when occasion offers, should not allow the fascinations of other sciences to lure him away from his especial study of the Coffee Plant, until he has got a thorough grounding in its nature, habits, growth, cultivation, enemies and preparation.

Perhaps the best way of conveying an idea of a planters general work is to give an example of an average day.

6.15 a.m. rise and dress.

6.30 a.m. give out tools and send the boys off to the various works.

6.45 a.m. to 8.15 a.m. visit the various gangs and see that they have all started working, and, if the nature of the work permits, give a daily contract.

8.15 a.m. Breakfast.

9.15 a.m. to 12.30 p.m. Visit the works—staying a little while with each—and between these visits take detours through the coffee for the purpose of observation of growth, state of crop, enemies, etc.

12.30 p.m. Lunch.

2 p.m. Repeat the morning's procedure as far as possible, but choosing a different route.

4.15 p.m. Tea.

4.30 p.m. Knock off work for the boys. Collect tools, mark the tickets and give out rations.

5.30 p.m. Give out pay to boys whose tickets are finished, enter up estate cash and record books. Deal with necessary correspondence.

During crop-picking seasons the latter part of the day will, of course, be affected by the necessity for taking in and measuring the cherry and supervising the pulping thereof.

Also during the day time the work of preparation of the coffee at the factory must be carefully supervised.

The young planter while learning the various methods of the necessary works will be kept more or less strictly to supervising the labour only. When, however, he has sufficient experience to warrant being put in charge of an estate himself his views of the work required of him should stretch beyond this. It is not at all advisable that he should spend all his day (except in the case of a vitally important work such as planting) in actually supervising his labour.

Few men can stand or sit about for hours with a gang of boys and allow a reasonable amount of rest for tired muscles, it is very natural for the planter to overtire his boys, or for the boys to overtire themselves early in the day by working at a continuous pressure, while the master is actually present.

Consequently directly he goes away the work ceases entirely.

It is much better if the Planter can get his boys into the way of working at a steady pace whether he is there or not and without continuous driving. The planter should be in the habit of turning up at any time during the day and from any direction, and he should scrutinise the character and amount of work already done without taking much account of whether individual boys are working hard when he arrives or not. It may be that the steadiest worker of them all may be taking a short respite at that moment.

On the other hand the Planter's scrutiny of the work done must be close enough to expose showy but shallow work and the offender should be called back to do it again. The question of punishments for habitual bad work must of necessity be left to the sense of justice and fair play of the individual planter.

It must, however, be said, that, if the planter is in the habit of endeavouring to profit financially wherever possible out of the mistakes of his boys, labour will quickly recognise his game and his reputation as a good master will suffer.

This in a country, in which labour is very largely independent, is a serious matter and may cause grave loss through labour not being procurable, when urgently required.

Although it is not at all advisable for the planter to do much manual labour himself, yet it is a good thing if he is able to show a boy how to do any particular job of work by personal demonstration.

A set of useful muscles displayed in this way will do nothing but good, but it should end there, when it will serve the double purpose of keeping the planter himself fit and impressing his labourers of his ability to do their own work as well as themselves.

ESTATE BOOKS.

These are divided into two classes, viz: account books and record books.

Of the former it is not intended to say very much for it is obvious that accurate accounts must be kept if an estate is to be run on remunerative lines.

Too much stress, however, cannot be laid on the absolute necessity of prompt and detailed entries of all daily cash transactions.

The planter—however busy and hard working—who gets into the way of delaying entries of such petty payments until he has more time with the best intentions in the world will most assuredly find very considerable discrepancies in his cash balance, for which he should be entirely responsible.

The very great importance of complete and comprehensive record books is not nearly so generally recognised. And yet these records are of the very first importance in the scientific development of an estate.

No man's memory is infallible and scraps of paper on which important notes are sometimes made, as often as not go astray and thus perhaps some valuable link is lost.

It is most strongly recommended that a suitable system of weekly and monthly Record books be brought into general use from the day of the first clearing on a new estate.

There will be no need to labour the points of the usefulness of such a complete record of development, if the reader will for a moment think of the few of the hundred and one occasions on which he might require to make reference to such a record.

Also a more or less detailed weekly or monthly report of the progress of work is invaluable and an absolute necessity where a non-resident owner takes any interest in the condition and progress of his property.

Two useful forms for such weekly reports and monthly estate Record Books appear (see diagram) the general adoption of which would, it is hoped materially improve the standard of coffee planting in this country.

Dr. CASH ACCOUNT ..... ESTATE FOR WEEK ENDING ..... 192 *Cr.*

DATE		SHS	CTS	DATE		SHS	CTS

STOCK ACCOUNT		LABOUR ACCOUNT		CROP ACCOUNT TO DATE
STOCK ON 1ST		CONTRACTED		No. OF TINS PICKED .....
INCREASE		UNCONTRACTED		No: OF BAGS DESPATCHED
DECREASE		DAILY AVERAGE		"P" SIZE .....
TOTAL				"A" " .....
PLANTING ACCOUNT				"B" " .....
NO OF COFFEE TREES PLANTED				"C" " .....
NEW CLEARINGS				"T" " .....
SUPPLIES				"E" " .....
TOTAL				MBUNI .....

WORK DONE DURING MONTH

Front of Sheet

LABOUR ACCOUNT OF ..... ESTATE 192

DATE																																TOTAL	CARPENTERS	MASONS	MECHANICS	RAIN FALL
TOTAL																																				

Reverse of Sheet

CHAPTER X.

ON THE GENERAL WORK OF AN ESTATE.

ESTIMATION OF CROP.

This is very largely a matter of experience, but there are certain points which may be of value to the novice.

In fully-grown coffee, provided that the ground is sufficiently covered by the trees, the distance of planting need not be taken into account.

For the first few years of bearing however, the number of young trees to the acre must make a difference to the yield.

For some weeks probably before the actual blossoming the keen planter will have been observing and making preliminary estimates on the possible crop as shown by the blossom spikes.

The degree of development of these spikes and the amount of rain received will largely influence the percentage that will flower. Consequently estimates will have to be revised after rain when it can be clearly discerned how much of the spike has moved. The blossom should open about ten days after the rain. The last day before the blossom opens is the best time for making the final estimate as the spikes are then very large and white.

The estimating should be done in the morning or the evening when the sun is off the coffee, as otherwise the shining of the leaves makes anything like accuracy impossible and even so it is as well to look away from the light as much as possible.

Do not try and estimate so many hundred weights per acre over the whole estate. It is much better to divide the estate up into blocks of roughly known acreage and make an estimate on each.

The pollination is carried out by all kinds of insects, winged and wingless and it is probably due to the small species of the latter such as the tiny Ants, that a blossom sometimes sets that has not appeared properly to open.

Modifying factors are the health of the trees and the amount of moisture in the ground. The previous estimate should be checked when the berries have begun to swell, as according to circumstances all or little of the blossom may have set. One of the best ways perhaps is to make an estimate of the average number of berries in the bunches. If these number as a rule 18 or over, the blossom may be considered to have set "in toto"; if, however, the average appears to be only 12 to 14 a reduction should be made on the original estimate.

Estimates may have to be altered in the course of the year from unforseen and irremediable causes, but nevertheless they should always be made in order that the year's estimate of working expenditure may be based upon them. A small margin for error should always be allowed as it is better to under, rather than to over estimate.

WEEDING AND CULTIVATING.

It is important that a good tilth be kept up in the coffee in order that the maximum amount of moisture may be retained in the soil in dry weather. It is also necessary to keep the coffee free from weeds as much as possible in order that the coffee roots may not have to compete with other roots for their food.

If labour is available, the only time when weeds are permissible is during the rains, when even some good may be done by weeds by stopping wash of top soil.

As soon as this danger is over and before the weeds can seed the estate should be cleaned. It is not advisable to cultivate deeply in coffee at any rate after the first few years, until the trees have filled in considerably a good deal of labour is saved by using an ox-drawn cultivator for the centres of the lines and hand labour only for the areas close round the tree stems.

As has been mentioned before, careful scrutiny should be made ahead of the cultivators to note whether any deeply rooted weed such as Cough Grass is present, which if found should be immediately dug out very thoroughly with pointed sticks.

The employment of the "dutch" hoe for hand labour would probably result in increased speed of work and also give a light and useful working to the top soil round the coffee stems.

CAPPING AND PRUNING SYSTEMS.

THE SINGLE-STEMMED TREE.

Up to the present day the only generally recognised system of growth allowed in Kenya Colony has been the Single Stem System, which necessitates a large amount of pruning and handling.

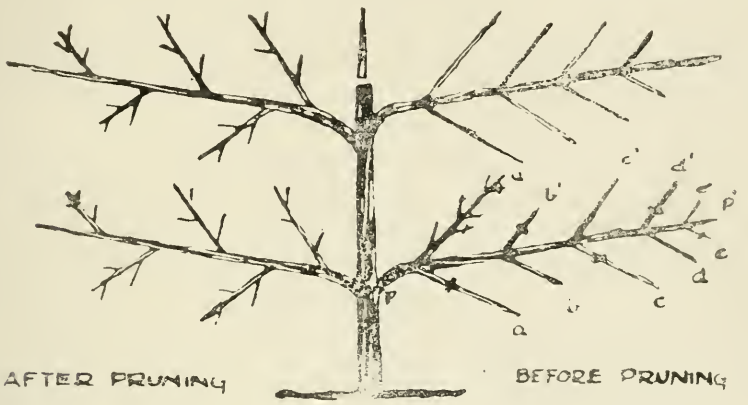
The Single Stem Tree is usually capped once or twice in the course of the first few years, in order to strengthen the stem and branches below the level of the capping and to induce an extra growth of secondary lateral branches.

The tree is then finally topped at whatever may be the required height being, as a rule between 5 and 6 feet.

The pruning in this method, is heavy since the tree being much limited in size and height by reason of the topped single stem, the amount of bearing wood required to produce a fair yield of coffee berries must be concentrated in the secondary and

tertiary branches of a very limited number of primaries. Hence the tree is apt to become very thick and matted, a condition which is detrimental to the health of the tree, through lack of a good air and light circulation.

The system of pruning a normally shaped tree is usually as follows:—All suckers secondaries and leaves are removed for about six inches round the stem from top to bottom of the tree. Each primary is then taken in turn and finished completely before passing on to another. The usual method is to leave a limited number of secondaries alternated on each primary; the tertiaries from the secondaries being chosen in like manner.



In the diagram P P' is a primary, lateral branch: a a', b b' c c' d d' e e', are secondaries which branch out in pairs from P P'. Each of these pairs is supposed to be about of equal growth and strength except b' which is shorter and weaker than b. b then will be taken as the 'key' secondary and a, b', c, d', e will be removed leaving a' b c' d and e', as the wood on which the next crop is to be borne. a' will probably bear tertiaries and the selection of these should always begin with one growing away from the primary, and then left alternately as in the case of the secondaries.

All branches which grow upwards or downwards or through the centre of the tree and also those that are growing immediately above or below the parent branch should be removed before the final selection is made.

All dead wood must, of course, be removed and weak and whippy primaries should be cut back to allow a strong secondary to replace it.

It is very difficult—in fact impossible—to lay down hard and fast rules for pruning, since the individual variations of the trees are infinite. Consequently much must be learnt by actual experience and the foregoing is only intended for a general guide on which to base an individually evolved method.

One point should always be borne in mind—never use a knife where the work can be done as well by hand, as the latter is far the quicker and more efficient instrument. The knife should only be used to cut back primaries or other thick branches and then the cut should be trimmed as carefully and closely as possible at the axil so as to leave no stump.

Other systems, viz: the Two Stemmed, Three Stemmed, Four Stemmed, Agobiada and Lemings are either in their infancy in Kenya or have not even been tried.

TWO STEMMED.

The first mentioned—the two stemmed tree—is really a glorified edition of the Single Stemmed: its chief attraction being that with an initial very low capping it results in an exceedingly sturdy tree having more bearing wood than in the case of the single stemmed.

All the other systems are operated as a means whereby the labour necessary for the pruning may be largely saved. The idea is that a sufficiency of primary branches—obtained by multiplying the number of stems—will yield the required crop without necessity for secondary branches, which are then plucked out by hand at once.

THREE STEMMED.

The three Stemmed Tree is obtained by cutting the original stem down and allowing three suckers to grow up and form new stems.

FOUR STEMMED.

The four Stemmed Tree is an adaptation of the two stemmed. The original stem is cut down and from this two suckers are allowed to form stems, these in turn being capped and two more suckers on each being allowed to remain.

AGOBIADA.

The Agobiada aims at the same results by another method. The young plant when perhaps 15 to 18 inches in height, is bent over and held in this position by means of a forked stick driven into the ground. Suckers grow in a vertical direction from this stem and 3 or 4 of these are selected to form the new stems of the trees. It is the primaries of these stems that bear the crop, all other wood being removed.

As any of these stems become broken or inefficient through loss of primaries another sucker is allowed to grow up when the former will be cut off.

The pruning of such trees is, therefore, of the simplest and the stems being easily bent, the picking of crop is also rendered easier.

LEMINGS.

The Leming system is simplicity itself as far as pruning goes, for to all intents and purposes none is required.

The original stem is cut low down and any number of suckers allowed to grow up to any height. The growth of the tree being perfectly natural, no secondary wood is produced at all. The weight of crop borne on these stems bends them over and before long breaks them, but they are immediately replaced by others, which are growing up all the time. In S. India a block of coffee grown under this system was estimated to yield about 7/8 of the crop produced by the more carefully cultivated single stem trees, and of course the labour required to work it was very much less.

This is only an estimate, for unfortunately no careful experiments were made to check it.

DISTANCE OF TREES.

In the case of all the four last mentioned systems the distances of planting must be considerably wider, as the trees will be much larger.

The Agobiada will probably require the widest planting of all and 20 ft. x 20 ft. is apparently not very uncommon in Guatemala though such wide planting will probably not be necessary in Kenya; perhaps 10ft. x 10ft. will be found to be wide enough. It will very probably be found suitable in Kenya to plant very much closer to start with, and to treat every alternate tree and perhaps in even every alternate line as well (i.e. quarter of the total amount of trees planted) for permanency, the remainder being gradually cut out as the permanent trees spread.

This method has the advantage of utilising a greater portion of the area from the commencement and increasing the amount of the initial crops which are usually of very good quality.

HANDLING AND CENTREING.

These works are a type of light pruning. Handling is frequently performed a little while after a heavy pruning, and consists in removing by hand the large number of unnecessary shoots that are produced as a result of the pruning. Knives should not be used. Handling may sometimes obviate the necessity for a regular pruning when, after a moderate crop, the trees are in fair but not dense foliage.

Centreing should always be done by boys when handling trees, but it is often of great advantage to the trees to run

quickly through the estate or even a block of coffee doing this work alone.

The work consists of clearing the centres of the trees for about 6 inches round the stem, free of all suckers, leaves and branches other than primaries.

PRUNING OF SHADE.

Shade Lopping, as this is very often called, should be carried out just before or in the early part of the rains, in order that the trees may have every opportunity of filling up the gaps that may be caused before hot weather begins.

The main object in pruning shade trees is to induce them to cover with a light regular shade the maximum area per tree and this object should always be kept in mind.

If it is necessary to cut out a tree completely, all the branches should be cut off first.

Should the tree be at all large and the branches heavy, the best method is to tie a rope a few feet along the branch that is to be cut; lead this rope over another branch and then down to the ground where one or more boys can hold it according to the size of the branch to be cut. The branch is then cut between the rope and the trunk of the tree and lowered gently to the ground. When teaching boys this work it is as well to keep a watchful eye open for accidents.

Boys have quite often been noticed sitting astride a branch and cutting unconcernedly between themselves and the tree!

SUPPLYING UP MISSES.

When planting weather has arrived the claims of the older coffee should not be forgotten in the anxiety to plant up new land. In fact before the rains begin boys should be sent right through the already planted coffee to make pits where plants or trees have died out.

When the opportunity comes to supply up, it is a good plan to send boys in pairs, one to go a little ahead and fill in the pits, and the other to follow and put in the plants. It is advisable to mulch plants that are put in amongst old coffee wherever it is at all possible to do so.

REPAIRS TO TRENCHES AND FENCES.

Once fences have been put up round any estate and trenches dug to keep out Cough Grass they should be kept in repair. It will be found to be but a small expense to send three boys round every six months with a small amount of wire and a few staples. Also here and there a post will have to be replaced, but, if these fences were originally erected with hard

wood posts, such as Mohogo or Olive, it will be found that they will very seldom require replacement.

Trenches should be cleaned out regularly or grass will encroach.

CLEANING OF FIRE PATHS.

Where coffee adjoins open grass lands that are more or less regularly burned, the cleaning of the fire paths should not be forgotten. They should not be less than 25 ft. wide and if possible roughly ploughed up, so as to make it quite impossible for fire to find a bridge of roots etc., by which to cross.

REPAIRS TO ROADS AND BUILDINGS.

These likewise are regularly recurrent works and should never be unreasonably delayed. A building or road that has been allowed to get in a really bad state of repair will cost far more to render it serviceable again than if timely repairs had been executed previously. Roads and paths should be kept free of grasses, especially those which spread from the roots or trailers.

The cleaning of roads and paths should be done before any weeds growing on them have a chance of seeding.

RENOVATION OF OLD COFFEE.

It may not be out of place at this point to recount the procedure adopted in certain parts of S. India for the renovation of very old coffee. One of the best pieces of coffee that the author has ever seen anywhere was a 5-year old piece that had been treated in this manner. It may also be of interest to the reader to know that an experimental plot is being tried with some coffee that is fairly old for Kenya.

Unfortunately the time of year, when these trees were cut, turned out to be somewhat unsuited to the experiment, but those trees which have suckered are doing well.

The procedure is as follows:—

For a couple of seasons previous to cutting down, the trees are allowed to crop as heavily as possible.

All the shade trees are then felled and the coffee trees cut down. The important part of the whole experiment lies here:—The earth should be scraped from round the stem of each tree until the first thick lateral root is exposed. This will probably be three or four inches below the nursery mark on the stem and from 3 to 6 inches below ground level. The stem of the tree is then sawn off just above this root and below the nursery mark.

The earth from close around is then heaped up over the stump and this is covered with a thick layer of green grass or weeds just before the burning. The small branches of the coffee and shade trees are spread over the area and dried. If this is not sufficient any dry grass, leaves, etc., that are handy are added and the whole burnt by a sharp quick fire. The soil over the whole area is then thoroughly worked and a good dressing of lime dug in.

When this has been done, the earth may be removed and the stumps exposed. Suckers will grow up from these stumps and should be allowed to grow in a clump until of sufficient size to facilitate selection.

Two or three are selected and the rest removed, and the earth heaped up slightly so as to cover the bases of the suckers. Later a further selection should be made and one sucker left to form the new tree.

It should be noted here that protection against cut worm must be provided. New shade trees should be planted.

The burning of the area rectifies the condition of the top soil and drives the sap in the coffee stumps down into the roots. These stumps lie dormant for a while, but with the rains the sap rises and the full vigour of the old root system is occupied in developing the suckers. This is then narrowed into two or three selected suckers and finally into one, which consequently grows at a great pace.

The interest in this method lies in the fact that, since the sucker is developed from "root wood", it begins after a couple of years to form a root system of its own, and after some years the curious sight may be seen of the old, and by that time disused, coffee root pushed aside by a completely and entirely new, vigorous system supplying an equally new and vigorous tree.

CHAPTER XI.

ON THE MANURING OF COFFEE.

NECESSITY FOR MANURING.

This most important side of Coffee Cultivation has in the past received all too little attention from Kenya Planters. The common contention that the soil is as a rule very rich is exceedingly short sighted.

It is true that the soils of a great part of Kenya are extremely rich, but they certainly are not inexhaustible. Very possibly no manuring will be actually required for the first 4 or 5 years in a rich soil, but thereafter if the planter wishes to keep up the standard of fertility of his soil, something must be put back to replace that which is taken out every year by the crop.

The amount of this crop must not be computed as the comparatively few cwts. per acre of Clean Coffee obtained, but as the total of Cherry which is very different matter since the proportionate weight is about 1 : 7. Certainly the most concentrated part of the total yield is in the bean, but nevertheless the pulp and parchment contain much of the essential elements of plant food, which are regularly being extracted from the soil.

Manures may roughly be placed in four groups, viz:—

1.—Green Manures.
2.—Bulk Manures.
3.—Organic Manures.
4.—Chemical Manures.

Of these the first two are within reach of every planter in Kenya.

GREEN MANURES.

The application of Green Manure consists in growing a crop of some Leguminous weed such as Crotalaria, which is cut over just before flowering and lightly dug in. The effect of this is to return to the soil the Nitrogen that is fixed in these plants,which also add to the humus, supply other plant food as they decay, and also increase the mechanical efficiency of the soil.

BULK MANURES.

This class of Manure is practically, and, in fact entirely the only present supply of applied manure used in the country. This class is composed of the following:— (a) Mulch (b) Dung (c) Pulp.

All of these are valuable in their own manner and under certain conditions of treatment and the object of their application is the same, viz: to supply a mass of readily available plant "food" which will steadily build up and maintain the vitality of the coffee trees and which will also assist in retaining moisture in the soil and generally improve its mechanical condition and texture.

The application of mulch is particularly for this latter purpose. A thick layer of several inches of dried grass or leaves being spread over the ground, the moisture is to a considerable degree prevented from evaporating. The mulch as it rots away forms a valuable addition to the humus.

A sufficient air space should always be left immediately around the stems of the coffee trees.

Cattle and goat dung is by far the commonest manure used in Kenya.

Considerable quantities are available by purchase from the natives beside the sweepings from the cattle bomas of the various estates. The present price of cattle or goat manure brought on to the estate is 5 Florin cents per tin (kerosine.) This works out at approximately £3 10/- per acre, where the planting is 8 ft. by 8 ft. and, allowing for an application of one tin per tree, this would probably total 6 tons per acre.

It, however, seems improbable that cattle and goat manure will remain at this price for long, since in the near future there will in all probability be an enormously increased demand. Dung should not be bought if very dry as it means that most of its value has been lost.

Pulp by itself is not of great value and, when applied thus, acts mainly as mulch for the retention of moisture in the ground, but it becomes a large source of supply of great value, when prepared in conjunction with the two manures previously mentioned and with Lime to form Pulp Compost.

PULP COMPOST.

Very satisfactory results have been obtained in other countries from the application of properly prepared Pulp Compost and chemical analyses have proved its value as a plant food.

Planters in Kenya, who have an eye for future conditions, and much greater competition, should seriously think of utilising regularly this natural source of supply for the benefit of their estates.

It is commonly supposed that the preparation of Compost is both costly and exacting, but in practice this is not the case. It certainly entails a certain amount of daily work, but it will be seen that this even will cost but very little, while, since all the materials except the Lime are already at hand and cost nothing, the value received from the finished product is out of all proportion to the cost of preparation, the only drawback being its bulk.

If, however, the total costing including transport to the coffee and application be computed and its chemical value be taken into consideration, there is little doubt but that carefully prepared Pulp Compost is the most satisfactory supply of plant food that is available to every planter, who has bearing coffee, throughout the country.

The preparation of Pulp Compost is performed in the following manner:—

Select a level piece of ground near the channel that carries away the pulp and build a rough shed over it. Break the channel at the nearest point to this piece of ground and insert a small strong platform with a fine grating on to which the contents of the chanel will pour. The water will fall through and the pulp be left on the grating.

During the time that the pulping is being done one boy stands by the grating and shovels the pulp to one side with a wooden shovel.

This pulp is then carried to the stack and spread in an even layer over the whole surface. A layer of 2 or 3 inches thickness of some dry material such as dry manure, dust, straw, dryed grass from cleaning the roads, sweepings from the factory, parchment husk from the Hullers, etc., should then be spread over the layer of wet pulp.

The two layers will be made daily, while regular pulping is being done and every few days a little Lime should be spread over the wet Pulp before covering it with the layer of dry material. The amount of Lime necessary is largely a matter of experiment and experience, but perhaps 56 lbs. of Lime to 10 tons of cherry pulp would not be greatly in error. The object of the daily layers of dry material is to absorb and conserve the valuable liquor from the next day's layer of wet pulp, and also to protect the lower layer of pulp from too rapid reaction from the sun and atmosphere.

The use of the Lime is to render possible the nitrification process as the pulp decomposes.

Manure from the cattle boma should be dried outside, but under shelter for a while before using with the Pulp.

The stack of compost, when the crop is finished, should be allowed to mature for at least six months under cover. This may be done either by enclosing the stack in a covering of grass, etc., or else carting it at once to pits conveniently situated in the coffee and allowing it to mature therein under a covering of earth or dry grass. The latter method perhaps is

preferable as the shed under which the Compost is made will be available for the next crop.

Neither dung, pulp, or pulp compost, should ever be applied to coffee in a fresh condition.

APPLICATION OF BULK MANURES.

Bulk Manures, such as those already mentioned are of necessity comparatively expensive of application. An ordinary dressing in Kenya in one M'debbie or Kerosene Oil Tin of manure to each tree. There are several methods of applying manures, but each and all of them should be done in such a way as to induce the roots of the coffee trees to stretch out as widely as possible in the search for plant food.

The widest possible feeding area per tree must be aimed at, as the whole area included within the limits, to which the feeding roots attain, will be the feeding area of the tree. The old system of piling a heap of manure up against the tree stems is absolutely indefensible for coffee as the whole tendency thereby is to restrict the spread of the root system thus depriving the trees of large sources of food supply, which would otherwise be tapped.

Bulk manure may be placed in a heap between four trees and then broadcasted, the ground, afterwards being lightly forked over; but perhaps of all the trench and holing systems the best and simplest is to dig continuous trenches midway between the lines of coffee and to make them in the transverse lines at the next application and so on alternately.

This has the merit of inducing the roots of each tree to occupy fully their allotted space, and it also concentrates the bulk of the weeds—which are also introduced in dung manure—into narrow ribbons, which are easily dealt with.

These trenches should be made about 9 inches wide and a few inches deep. A tin full of manure will be found to layer such a trench quite thickly over the distance between two trees. The earth should then be returned in order to cover the manure lightly. The work entailed in the cutting of the trenches is very light, (women working for firewood can do about 250 yards in half a day with pangas,) and the work of returning the earth is almost negligible, as a boy shuffling along with one foot on either side of the trench can do hundreds of trees a day.

Almost all the expense of applying bulk manures lies in the transport, but the realisation that this is one of the most necessary and most remunerative work of coffee cultivation will go a long way towards improving and stabilising the standard of coffee produced in Kenya.

ORGANIC MANURES.

These manures, which include Guanos, Bone, Fish, Poonacs (i.e. the residues from oil crushing) etc., are extremely valuable since, while being of a concentrated type and therefore not bulky, they form a strong and lasting plant food. Unfortunately at the present time they are scarcely any easier to procure than Chemical Manures.

This should not be the case, as there are vast quantities of bones in the country requiring only to be collected and crushed, while there seems to be no valid reason why fish should not be dried and sent up from the coast in either a whole or disintegrated form.

Where a fairly rich soil is only slightly deficient in Phosphoric Acid, coarsely crushed bone is an excellent manure that will be a continual source of supply of Prosphoric Acid for many years. In other cases Bone should always be crushed to a fine meal.

An average application of such Organic Manures would be 4 to 5 cwts. per acre.

CHEMICAL MANURES.

Manures of this class, with the exception of Lime and Potash Salts are stimulants to coffee rather than foods. Their action in the main is to force the coffee trees into a rapid development, from which—if no more substantial and lasting sustenant is provided—the trees will relapse to their previous state only in a rather more exhausted condition.

Concentrated Chemical Manures should but rarely be required in rich and virgin soil such as is much of the coffee land in Kenya.

They are more for the use of long-developed countries, where the cultivation is intensive and a rotation of crops is grown that will not drain the soil of certain ingredients only, in the manner of a non-changing crop such as coffee. An application of chemical manure may upon occasion be useful in giving a needed fillip to somewhat exhausted but otherwise healthy trees, in order to enable them to take fuller advantage of some favourable season, but such an application should always be followed at a short interval by an application of an Organic or a dressing of bulk manure.

Chemical manures should not be applied by anyone, unless he has considerable experience, without soil analysis or the advice of an expert to make sure of the lacking ingredient, which it is required to supply.

Lime, although a chemical manure, must be placed in a different category. It is an essential ingredient in soils and forms with Potash and Magnesia the main basis for the formation of the Nitrates, which provide Nitrogen to the feeding roots of the coffee.

Lime may frequently be applied in small quantities by means of spraying and dusting mixtures, and when used as a distributing base for applying very concentrated manures, but in addition it may occasionally be advisable to give the coffee a dressing of from ½ ton per acre upwards. Wherever possible Lime should be applied soon after a dressing of Dung.

APPLICATION OF NON-BULKY MANURES.

It is better to apply manures of any class in small amounts and frequently rather than large amounts at rare intervals. This naturally means more labour, but it also means a fuller use of the manure and less wastage.

The application of concentrated manures and other organic manures such as fish and bones is a work, which requires close personal superintendence on the part of the planter.

The reason of this is that much of the vitality and well-being of the coffee trees in the near future lies very largely at the mercy of that most uncertain factor the ordinary unskilled labourer. It is by no means an unknown thing for a boy, who thinks that he is not being watched, to save himself the trouble of carrying a fairly heavy tin or basket for some distance with very frequent stops by scooping out a small hole and emptying into it the greater part of the manure he is carrying, thereafter proceeding with a light load, while pretending to be busy.

The effect of this is that one or two trees may receive an overdose of concentrated stimulant sufficient to kill them, while many others go without it altogether.

Before beginning to apply such non-bulky manures the planter should very carefully measure out the amount of the application per coffee tree. A number of tins of the same capacity should be provided—one for each labourer—and the planter should carefully instruct each labourer how full of manure he should fill his tin for spreading to each tree. Each labourer should have a large tin or basket full of manure, from which he takes the requisite amount for each tree, as he proceeds along his line.

It is best for each labourer to walk down the centre of the space between 2 lines of coffee and scatter each tin full of manure over the area bounded by the 4 trees in front of him. This will ensure an even distribution.

Bags of the manure should be carried out into the coffee and dumped in several places in such quantities as will enable the planter to keep a rough check on the accuracy of the application.

This means of course, that previously the planter must have worked out the number of bags necessary to complete a certain acreage.

After the application has been finished a light forking or raking should be given to the soil in order to get the manure into the ground and to give it a light covering.

Except in the case of soluble salts, the best results will be obtained when manure is applied just before the rains.

CHAPTER XII.

ON THE PREPARATION OF COFFEE.

PICKING.

The preparation of the coffee for the market begins with the picking of the cherries.

Perhaps the first consideration of all is the nature of the receptacle into which the pickers will collect the cherry, for considerable time may be gained or lost by the use of an efficient or inefficient method.

The ordinary system in vogue at present in Kenya, viz: that of picking into the ubiquitous Kerosene Oil tin is one of the inefficient systems, for the picker has to turn round or bend down with each handful to avoid dropping cherries when throwing them into the tin, and also he has to move this tin round each tree as he picks. It must be obvious that the labour and time saving method is that in which each picker carries on his or her person a receptacle for holding the cherries.

There are various types of baskets slung from the shoulders and hand-picking bags slung or tied to the body, but perhaps the simplest and most efficient can be made out of the ordinary second hand gunny bag without any alteration to it.

The bag is folded lengthwise round the body and tied firmly at the waist in such a manner that the mouth of the bag hangs vertically downwards from the waist. The bottom end of the mouth is then caught up and tucked under the string or belt that is securing the bag. This forms a wide gaping mouth a little below the level of the waist into which the hands full of cherries may be plunged with the minimum loss of time. A very considerable weight of cherries may thus be carried in the bag with but little muscular effort. If the field in which the coffee is being picked is at some distance from the factory, arrangements should be made for the measurement of the cherries picked and the distribution of the metal tickets in the field. The cherries would then be filled into bags and transported by cart or waggon to the factory.

Everything possible should be done to enable the pickers to spend their time in picking and as little as possible in moving about and picking into awkward receptacles or carrying the crop for considerable distances to the place of measurement.

Planters would be well advised to study and institute on their estates any useful labour saving devices in this matter of picking, as it is a work that makes a very large demand on he labour supply of the country, and it is a demand that is

bound to increase considerably, since it is never likely that any satisfactory mechanical means will be invented for the picking of the cherries.

Under ordinary conditions the cherry should be allowed to ripen to a good bright-red colour before being picked, but in cases when for any reason the ripening of the crop is proving or likely to prove a strain on the trees, the cherries should be picked as soon as they are fit for pulping, i.e. when with a slight pressure of the fingers the beans may be felt to move within the pulp. It is never wise to delay the first picking for too long in order to increase the yield obtained from the first round.

The sooner the trees are lightened of the first part of their burden the quicker will they ripen all their crop, and the sooner will they start growth for the next crop.

M'BUNI.

There are two types of M'buni or Light Berry Coffee, both of which are usually saleable. The first type is produced when, for one reason or another the immature green berries die and turn black.

These berries are hollow and quite useless from a coffee point of view. They, however, command a fairly ready sale amongst Somalis at a price that usually makes it quite worth the planter's while to pick them separately if labour permits. This M'Buni is sent to Somaliland where it is dried, pounded to a powder, mixed with various substances and eaten as a porridge.

Somalis will also buy the second type which contains more or less matured beans. This is produced when more or less fully developed green berries begin to dry off, or when ripe cherry is allowed to dry on the trees. The best price for this is obtained before the beans are dry, in which state it is despatched.

An infusion made from stewing these—beans and dried pulp together—is drunk by the Somalis.

GLEANING.

This is scarcely ever done in Kenya. It consists in picking up the berries which fall to the ground from the trees, either during picking or from natural causes. If this coffee is collected before rain falls a very considerable amount of quite excellent coffee may be obtained which can also be dried and hulled on the estate.

In S. India this work of gleaning is almost invariably done and native contractors often tender quite considerable sums for the gleanings on the ground and they make their own arrangements for collecting them.

An expansion of markets for lower grade coffees would make it very well worth the while of the planter in Kenya to collect gleanings regularly.

PULPING.

The cherries are transported from the field and placed in a loft or tank situated above the level of the pulper. Through a hole in the floor of this loft the cherries fall into a stream of water passing directly underneath, by which means they are conducted into the hopper of the pulper.

An important point must be noted here—one or more catch pits must be provided, through which the stream of water passes before receiving the cherries, in order that stones, etc., which are being carried along by the impetus of the stream, may be prevented from passing into the pulper. A stone may quite easily mean a broken pulper barrel or breast, and perhaps considerable loss through stoppage of pulping in the very midst of the picking

A very good method which entails but slight extra expense and which will make certain that overheating of the cherries does not occur through delay in pulping is to make the cherry loft in the shape of a tank into which the water flows. This tank is provided with a siphon by which the coffee and water pass into the hopper of the pulper, thus obviating any possibility of stones passing into the pulper with the cherries. Spare parts for the pulper should be kept in stock.

An inexperienced planter should endeavour to gain some actual experience of the pulping of coffee on some other estate before he has to conduct the operation himself.

The initial and yearly re-assembling of the pulper should be the personal care of the planter and should be carefully tested by hand power with a tin or two of cherries, picked for the purpose, and adjusted until no beans are broken or nicked, as they are ejected from the "ports" and no beans pass through with the pulp and water and so become lost.

A sufficiency of water is an absolute necessity for the best results in pulping, and storage must be provided for this if the delivery of the stream is insufficient.

The amount of water necessary for 2 Gordon's "B" Size Pulpers and a "Segunda" when working at full pressure may be reckoned at about 2,400 gallons per hour. To this must be added the water necessary for washing so that an estate, which aims at such development, as will produce one or two tons of clean coffee per day during the time of heaviest picking, should be provided with water storage to the amount of 8,000 to 10,000 gallons, where the supplying stream or spring runs so low as five gallons per minute.

The planter, when computing the necessary amount of his water storage, should leave an ample margin for contingencies, since a shortage of water at a critical time will mean very considerable loss.

During the actual process of pulping the planter should satisfy himself at frequent intervals that the distance adjustments of the pulper have not altered. This can be verified by

taking a handful of beans from each hole of the breast and seeing that no beans are being cut, and by taking a handful or so of pulp from the overflow channel and ascertaining that no beans are being passed.

Green or insufficiently ripe berries are bound occasionally to be picked and these will generally be "skinned" by the pulper, which however should not be readjusted on that account.

The damaged beans should be separated later and greater care exercised in preventing the picking of unripe berries.

Cherry should if possible be pulped on the same day as it is picked. If, however, for any reason it is necessary to delay the pulping for more than 24 hours the cherry should be thoroughly turned over and liberally watered two or three times a day; it may even be necessary in case of long delay to put the cherry into one of the washing vats full of water.

The beans, the pulp, and the unpulped berries, which pass through the holes of the pulper, should be sieved and the two latter returned to the hopper of the pulper. The beans after passing through the sieve are carried on into a fermenting vat.

When choosing the first pulper in the case of an estate that is just coming into bearing it is necessary to remember that, although a single small pulper may be sufficient for a season or two, it will speedily be necessary to instal machinery having a greater outturn. Thus it is much better to purchase at once a single full sized (Size "B") pulper which can in the future be re-erected and coupled up, with one or more others of the same size.

It is not intended here to dilate upon the merits of the various types and makes of pulpers, as full and useful information may be obtained by perusal of the catalogues issued by Messrs. John Gordon & Co., and Messrs. Wm. MacKinnon & Co.

At the present time the "Cylinder Pulper" is almost universally used in Kenya, and, if a little care and attention is given to it, the results are excellent. The "Disc" type is, however more simple.

FERMENTING.

This is an important process in which ignorance or carelessness will probably result in a loss in value of several pounds per ton of cleaned coffee.

The coffee beans are enclosed in a parchment skin, between which and the pulp of the cherry is a covering of slimy saccharine matter. After pulping, bacilli soon start a fermentation process in this saccharine matter, which after some hours may be washed completely away from the parchment.

The quality of the clean coffee is likely to suffer if either over or under fermentation is allowed, therefore care should be taken that the washing is done at the right time. Take a handful of the parchment coffee and crush in the hands; if the beans grate together as though they were pebbles the fermentation

is sufficient. If, however, they feel slippery besides slimy, they should be allowed to ferment a little longer. The time will vary very considerably at different altitudes, at different times of the year, and for different types of coffee, and the process will take longer in cold weather. Perhaps 15 hours would be a fair average figure.

If the coffee is insufficiently fermented the saccharine matter cannot be completely washed off and the parchment will be sticky even when dried. This will absorb moisture when stored and "mustiness" will probably result.

Over fermentation causes a yellow or reddish discolouration of the beans, somewhat like that caused by over ripening, which latter, however, only affects the silver skin, i.e. the skin between the parchment and the bean itself. These beans are called "Foxy" beans.

WASHING.

When the coffee has been sufficiently fermented, the next process is to wash off all the saccharine matter and at the same time to separate the light beans from the heavy.

In order to get the saccharine matter quite loose, it is a good practice to make the boys tread the coffee thoroughly with their feet as it lies in a heap in the fermenting vat.

If it is feasible to do so, fix up a "shoot" on to the feed pipe leading into the hopper of the pulper, and run some water into the fermenting vat. By this means transfer the coffee to the washing vat (for plan of vats, etc., see end of book). A stream of water is then turned on to the vat and the coffee well stirred up and drawn back against the stream by means of long handled wooden rakes. If a tail vat is being used, a half screen door should be put in between the washing and the tail vats and the coffee beans that float should be gradually cleared off with water into the tail vat.

When the coffee has been very thoroughly stirred and all the lights taken off these should be removed from the tail vat and dried separately.

A sieved door may now be substituted for the half screen door and the coffee continually and very thoroughly dragged back against the stream of water.

By degrees the Pulp and the lighter beans will be seen collecting at the bottom end of the vat, as they are more affected by the force of the water, than the solid heavy beans.

When the bulk of the Parchment has thus been washed clean, the sieved door may be lifted slightly and the pulp and lighter beans allowed to flow into the tail vat, whence they may be taken and dried separately or with the first lights according to the planter's wishes.

The clean washed parchment is then taken out of the vat and put on mats or trays to dry.

There are three essential points in washing which the planter should observe:—

1.—See that all the vats are thoroughly cleaned, both before and after washing and that no stray beans are allowed to remain, and mix with the next lot of coffee. Such beans are greatly over fermented and give off a most offensive smell. They are called "stinkers" and detract very seriously from the value of the sample.

(The best guarantee against overlooking of stray beans as above is to have all corners in the fermenting and washing vats rounded.)

2.—Use clean water for the washing, i.e. water that has not become stagnant and musty, or "grassy."

3.—Always wash the parchment back against the flow of the stream.

The above method is the only one feasible for small estates, as the initial expense for either a washing channel or a washing machine is considerable. In the case of large estates, where a plentiful supply of water is available the washing channel with its accompanying receivers or tanks is probably the most efficient method of washing the parchment.

DRYING.

Whether a mechanical dryer is used or not, it is advisable to allow the coffee to start drying in the open air. This will save much time in the former case and will allow of the dryer being charged up to full capacity.

Up to the present time in Kenya most of the drying is done on trays or mats, occasionally combined with a mechanical dryer. Insufficient use has been made of the Barbecue system of drying, which, although perhaps not giving such even results as are obtained by mechanical means, is yet in many ways more satisfactory than the use of trays and mats.

These latter are comparatively speaking expensive and require a good deal of repair and replacement, so that the initial expense and upkeep of these will probably be nearly as great as for an equivalent area of Barbecue.

The Barbecue should be built on a level piece of ground and made of some durable material such as concrete, well crushed stone, or brick, and smoothly faced with cement.

Flooring tiles make a most excellent Barbecue and would well repay the extra initial cost, as they require a minimum of expense in upkeep.

Beaten earth is sometimes used but on the whole it is not satisfactory except for low grades of coffee.

Whatever means are used for drying the coffee it should be spread out thinly and turned over at short intervals in order to ensure an even drying.

In the case of trays and mats there is a likelihood of filling them too full with the consequence, that the beans are not properly turned and dry unevenly. This will make a difference in the sample.

Where a Barbecue is used, a boy may be put on to shuffling with his feet through the spread out coffee backwards and forwards in lines at regular intervals of half an hour or so; this will ensure a thorough turning of the beans. The Barbecues should be swept clean and the sweepings dried separately by themselves.

An open-sided or a sliding roof to cover over a portion of the Barbecue should be provided, into which the trays may be carried or the coffee heaped in case of rain.

Wooden rakes and shovels only should be used as they will not damage the parchment or break up the surface of the Barbecues or Vats as is the case with iron tools.

If a mechanical dryer is used it is still customary to allow the coffee to drain thoroughly for at least 24 hours before filling into the dryer.

For the first few hours, if the coffee is still somewhat wet, the temperature of the drier may be maintained at from 75deg. C. to 90deg. C., but should then be dropped to about 65deg. C.

To ascertain when the beans are sufficiently dry, take out a small handful from the dryer. Husk a few of these beans between the hands and try them between the teeth. They should be sufficiently tough to break without bending, but should not be at all brittle. If so, this shows excessive dryness. If others are cut with a sharp knife they should show a dark and somewhat polished surface at the cut.

For an hour or so before removing the coffee from the dryer the hot air should be cut off and the coffee allowed to cool.

NECESSITY FOR A STANDARD MEASURE.

This is a suitable juncture for pleading the urgent necessity for the use of a Standard Measure in Kenya. Few planters know anything about the correct degree of dryness for storing or bagging parchment coffee and there is no possible means of giving information on this point unless there is some standard measure, for which an average weight for parchment coffee can be given.

This lack of a standard measure and ignorance on the part of the planter gives rise to much trouble and misunderstanding. Here is an example:—

A planter sends a consignment of parchment coffee to a curing works out here or to London.

Quite unwittingly this coffee is sent in an insufficiently dried condition. On arrival at the works it has to be dried down very considerably before peeling.

The planter in consequence is very irate on receiving an outturn from the works for this consignment showing a loss of perhaps 35 per cent. instead of an average figure of 20 per cent.—22 per cent.

If, however, a standard measure such as the Imperial Bushel were in general use, the curing works could instruct planters that the parchment coffee should be despatched at a standard dryness of from 32—34 lbs. per Bushel, which would entirely obviate all possibility of such misunderstanding as given above and in addition prove a valuable guide to inexperienced planters.

PEELING OR HULLING AND POLISHING.

The parchment coffee, having been sufficiently dried, the next process is to remove the parchment and at the same time a part of the silver skin.

The ordinary grades of coffee from Kenya are known as "Nairobi" coffee in London, and for this type it will not be necessary to remove the silver skin entirely. Some coffees require to be peeled under considerable pressure and polished but in the case of Nairobi coffees, it is unnecessary from the point of view of the London market.

The planter must decide for himself whether he will:

a. Peel his coffee himself.

b. Send it in the parchment to a curing works in the country.

c. Send it in the parchment to London.

In either of the two latter cases the coffee should not be dried right down to "peeling" dryness, as it will keep both its colour and condition better if slightly moister.

In the former case the planter has the choice of several machines of large and small capacity, which in careful hands are all very efficient. For such coffees as Tailings (Nos. 1 and 2) Sweepings dry-cherry, dry-green, etc., a No. 1 Africa or "Smout" Huller are the most suitable.

Much better results and a higher output will be obtained if, before peeling, coffee is warmed in the sun for an hour or so.

The planter should always if possible, personally supervise the starting of work when peeling and he should not leave until he is quite satisfied that the machine is working evenly and at a reasonable output without either breaking the beans or passing chaff or dried pulp through with the cleaned coffee.

A certain small amount of "triage" or broken beans will always be ejected with the chaff, but this amount should not be allowed to become excessive.

If the coffee is sufficiently dry it is purely a matter of patience and careful adjustment of feed and pressure to obtain a good output of well cleaned coffee, and experience of the particular machine in use is the best method of obtaining satisfactory

results. If too much pressure is used inside the Huller, the coffee will become overheated and so lose colour and value.

There is a good deal of difference of opinion as to whether it is more advantageous to ship coffee to London in parchment or to have it cleaned before shipment.

In the former case the advantages are, more efficient machinery; greater knowledge of the immediate requirements of the markets as regards grades etc., better colour if the coffee is sold within a week or two of peeling. The disadvantages are: greater weight for transport and freight charges; loss of colour if the coffee is kept for any considerable time after peeling and before being sold.

In the latter case of cleaning before shipment the advantages are:—
The colour of the coffee lasts better over a long period. The great disadvantage is lack of really expert knowledge of the cleaning process and insufficiency of produce to warrant the use of the most up-to-date machinery.

It would seem that if a coffee curing works capable of dealing with several thousand tons of coffee annually and with really first-class machinery under thoroughly expert management, could be erected in Kenya, there would be no doubt whatsoever that it would be better to have the coffee cleaned locally before shipment.

A small huller such as a No. 5 Africa would save considerable expense by enabling the planter to treat all the lights, dry cherry etc., on the estate, even if he decides to send his best coffee in the parchment to a curing works or direct to London.

These lower grades find a fair market locally and are also frequently shipped to S. Africa, Egypt, Marseilles, etc.

GRADING.

This consists in putting the clean coffee through a machine, which separates the beans into the various sizes required by the markets. This process, however, to be performed with the greatest effect, requires intimate knowledge of the vagaries of buyers and a large stock of sieves for each grade with infinitisimal variations in the size of the mesh, both of which are obviously beyond the reach of the average planter. Consequently it is better to send clean coffee to be graded in London where the demands of the market are closely followed.

It would however probably be of advantage to set up an inexpensive device with two sieves whereby the triage and elephant beans could be extracted and these lowest grades of coffee sold locally.

After grading, if this is done on the estate, or before the ungraded coffee is despatched, it is a very good thing, if possible, to run through it hand-picking out discoloured and marked beans, which detract considerably from the value of the sample.

BAGGING.

Clean coffee should be packed in double bags of 2¼ lbs. each or other equivalent weights. Up to 187 lbs. of coffee may be filled into each pair of bags, which will work out at 12 shipment bags to the ton requiring 24 actual gunnies. Thus the gross weight will be 187 lbs. plus 2 x 2¼ lbs. equal to 191½ lbs., which allows a sufficient margin for safety under 196 lbs., over which gross weight a higher draft is charged.

Bags should be turned inside out before being filled and they must be carefully and strongly sewn up.

ESTATE MARKS.

All bags must be stencilled with the "mark" under which the coffee is to be sold and with the grade of coffee contained in the bags.

A little initial forethought will save future inconvenience and may even be the means of a readier sale and steadier prices.

Each estate should use two marks one for the high grades and one for the low. Every effort should be made to keep up the standard of the high grade coffee, even at the expense of a considerably lower outturn, as, once the name of this particular coffee has been established, and it is known to be regularly up to previous standard, it will command immediate sale and on the average appreciably higher prices. The mark used for this high grade coffee should, therefore be a name that is reasonably short, easily pronounced and easily remembered. Buyers are only human and have no better memories than the average man, consequently no "crack-jaw" names or initials should be used for these coffees. Initials may well be used for the selling mark of the lower grade coffees, since it will be realized that it is not at all possible to maintain any definite standard.

If the district, in which the planter's estates lies, is well known for the quality of coffee produced, it would be as well to add this in addition to the name, thus—ZINGA, KAIMOSI.

SHIPMENT.

This is invariably done through the country agents of the various London Brokers. These agents usually take delivery of the coffee at the Railway station and arrange all details of transport to the coast, shipments, insurance, etc.

The chief firms of London Brokers represented in Kenya are:—

T. H. Allan & Co.,	Agents.	C. C. Monckton & Co.,	Nairobi.
J. K. Gilliat & Co.,	,,	J. W. Milligan & Co.	,,
Czarnikow	,,	Tyson Bros., Ltd.	,,
Lewis & Peat	,,	Standard Bank of South Africa, Ltd.	,,

CHAPTER XIII.

ON GENERAL SUBJECTS.

ADVANCES ON CROP.

A very convenient practice which is largely resorted to in Kenya at the present time is that of obtaining a cash advance from the Brokers's Agents in the country on delivery of coffee for shipment.

This advance is generally computed at 60 per cent. of the current market value for the particular quality and a further 15 per cent. is allowed on receipt of the shipping documents; interest on this advance being payable until completion of sale. The balance due to the planter after deduction of advances, freights, commission and other charges being then payable by the local agent of the London firm.

Another method of obtaining money in advance that is not uncommon is the hypothecation of a whole season's crop by the agent of a London firm in consideration of an advance in cash whilst the crop is yet immature and somewhat speculative. Yet again another method is to sell forward at an agreed price. Although it may at times be convenient to the planter to receive a sum in cash well in advance of his crop, yet it should be remembered that buyers, who deal with large quantities of coffee have much greater opportunities of forecasting the movements of the market and they will, therefore, be much more likely to get the best of the bargain. Also, where a crop is hypothecated to a firm in consideration of a previous advance, it is very natural that rather less care will be expended on such consignments, than on those that are sold on commission and on the sales of which the Brokers are anxious to please their clients.

COMMERCE AND MARKETS.

Coffee is sold in London by Public Auction on sample, the fairness of which is assured to the buyer by the bulking of all consignments of bags in their various grades under the supervision of the Port of London Authorities.

In the case of the new estate, that is just coming into bearing the planter would do well to send to London a sample of the first coffee produced on the estate for report as to its type and liquoring qualities.

When this is done, full details of the mark, under which it is to be sold in the future should be sent with the sample. A good initial report as to quality and type will often lay the foundation for the making of a "Crack mark," which will always find a ready sale and keen competition amongst buyers. London is by far the largest market for Kenya Coffee, and nearly all grades of coffee will find buyers there. The best qualities, however, find a much readier sale than lower qualities, and these again when in large consignments as against small. A practice occasionally resorted to for high quality and good liquory coffees by London buyers is to instruct local agents to buy on the spot on bona-fide samples sent to London previously. It can hardly be necessary to emphasize the value of such business to a country and it behoves producers to take very great care in such cases that the bulk of the coffee is fully up to sample.

There are, however, many other markets, where lower grades of coffee may be sold very often more readily and at a higher price than in London.

In view of the rapidly increasing production from Kenya it is most important that greater importance be attached to these markets and a regular export trade established therewith.

Some of the markets are—S. Africa, Egypt, Marseilles, Havre, Australia, and there appears to be a possibility of New York buyers taking an interest in East Africa Coffee.

Up to 1914 Trieste, Havre and Hamburg were large buyers of East Indian Coffee and Kenya producers might well consider carefully the possibility of opening a trade in Nairobi qualities with Havre.

CO-OPERATION.

The very general cry in most industries at the present day is the necessity for more and closer co-operation.

Coffee producers are by no means exceptionally situated and such saving of individual expense, greater production, more uniform qualities, and a consequently greater effect on markets could be obtained if coffee planters would co-operate with one another.

Conflicting interests on minor matters between districts and even neighbours have hitherto raised an insuperable barrier to the inception of co-operative methods on matters of great and even vital importance to the community.

Producers the world over are forming their own Co-operative Associations, Federations, etc., for the economical working and better and more extensive marketing of their produce, and, if the coffee planters do not follow suit, it is by no means beyond the pale of probability that another beverage may be skilfully "pushed" by modern methods of advertising, etc., to such an extent that the world consumption of coffee will become much diminished.

On the other hand, if producers of coffee were to combine in an effort to increase the world demand for that beverage there can be little doubt but that, under the economic conditions of the present day and the near future, a very considerable increase might be effected. In the same manner also co-operation could be used with great advantage from a co-operatively owned Producers Curing Works, to which all members' produce could be sent for treatment.

This would do away with one of the chief complaints about Nairobi coffee viz: diversity and bad methods of preparation and it would ensure that a large percentage, if not all of the coffee produced in Kenya would be prepared under expert supervision and would at least be uniform in preparation.

Similarly the planters of a district or a group of estates might profit greatly by the use of a co-operatively owned "Retrilla" or Hullers for the treatment of heavy m'buni, gleanings or green berries, the profits from the sale of such coffee being divisible amongst the owner members. This would greatly increase the amount of such qualities, as it would be worth while for every planter to collect them instead of simply allowing them to waste as is often the case at present.

For the efficient control of Pests and Diseases, Power Sprayers or Power Dusters, owned by groups of estates would be more effectual and in the long run more economical than for each planter to keep stocks of Hand Sprayers in sufficient quantity to cope successfully with any sudden outbreak.

Probably initial difficulties might arise as to preferential usage etc., but, if all planters were to bring to the settlement of such disputes a sense of fair play and subordination of individual to the general weal, these difficulties would speedily cease to be insurmountable and the whole planting community would benefit.

LABOUR SAVING DEVICES.

Coffee being a product, which requires a high standard of cultivation and a lengthy and expensive preparation in order to obtain the best results, it is therefore important to use labour-saving methods whenever practicable. The more so is this necessary because in much of the indispensable work, such as picking, etc., the possibilities of labour saving devices being invented is exceedingly remote.

The most common labour saving methods in general use are: Cultivation with ox-cultivators, cart transport on the estate to save carriage by labour, and elevators and conveyors at the factories, whereby labour is saved in the conveying of parchment coffee to the drying grounds, dryer or huller.

The principle of the ox-drawn cultivator may in the near future be extended to mechanically-drawn, and it is quite possible that some such machine as the petrol-power cultivator, which has been designed and built by Vickers Ltd., may be adapted for coffee and come before long into general use. A machine such as

this would in all probability do the work of ten Cultivators drawn by oxen, each with its attendant driver and leader, while the initial cost would be no more than, and very probably far less than, the purchase of oxen, gear and cultivators to do the equivalent amount of work.

A considerable amount of labour may also be saved by supplying tools better adapted to the work in hand as for instance, long-handled "Dutch" hoes for weeding round the stems of the coffee trees. Another device that has already been mentioned as saving much time and labour is the provision for the pickers of a conveniently handled receptacle—preferably one slung to the body —into which the cherries may be passed with the maximum of rapidity and minimum of loss due to slipping out of the hands and falling to the ground.

The intellgent use of such means for saving labour, whenever possible, therefore becomes largely the guage of the planter's care towards the working of his estate.

COFFEE LEGISLATION—THE PEST ACT.

Coffee being an intrinsically valuable crop, strict laws are necessary for the prevention of systematic theft and the possibility of any estate becoming a menace to its neighbours.

A stringently-worded Pest Act is therefore of the first importance and the powers devolved upon the competent Authority should be litttle less than arbitary.

Kenya Coffee at the present day is possessed of a considerable quota of pests and diseases and on the average but little is known about them by individual planters.

Although this is the staple export industry of the Colony, yet only one Government Officer is delegated completely to attend to the needs of the industry.

Coffee Inspectors are an increasingly urgent necessity, both from the point of view of preventing estates from being neglected to the extent of becoming a danger through unchecked diseases, etc., to surrounding estates, and also from that of giving experienced advice to inexperienced planters.

This could be done either by a small staff of inspectors in the Agricultural Department and under the immediate authority of the Senior Coffee Officer, or by the appointment by the Government of experienced planters in certain districts with certain powers in cases of badly neglected estates.

Whatever methods would be most suitable to safe-guard the planting interest against what amounts to almost criminal neglect, it must however be patent to every far-seeing planter that the strict enforcing of such a measure as a Pest Act suitable to the particular requirements of coffee is a matter of extreme importance.

FIGURES OF COSTING AND YIELD OF COFFEE.

The following figures of the Costing of Coffee, details of and loss in preparation, average yields, etc., may perhaps be of more use for ready reference, if they are all collected into one paragraph.

The figures given can only be considered as a reasonable average for Kenya at the present time, and must not be held to apply strictly to individual cases.

Particular conditions of altitude, rainfall, richness of soil, supply of labour, etc., etc., may in individual cases make certain of these figures quite erroneous. They are intended more as a rough guide to an intending planter, who is desirous of working out the possible returns to be obtained by investing his capital in a coffee estate in Kenya.

AVERAGE YIELD PER ACRE PER ANNUM.

Age calculated from planting of seed.

3rd year.	4th year	5th year.	Full bearing.
1 cwt.	4 cwts.	7 cwts.	7 cwts.

Losses in Preparation.

These figures vary considerably in different crops, much depending on the amount and seasonableness of the previous rains and other natural causes. 100 lbs. of cherry will yield under different conditions from 13 to 18 lbs. of Clean Coffee. An average figure through good and bad years alike may be taken at about 15½ lbs. or approximately 6½ lbs. of cherry to 1 lb. of clean coffee. The loss from dried Parchment to Clean is from 20 per cent—22 per cent.

Cost of Cultivation and Preparation.

An acre of fully bearing coffee including superintendence and a reasonable figure for manuring may be calculated to cost £10 per annum.

The cost of preparation, shipment, sale charges, etc of 1 ton of clean coffee from Nairobi is at an average figure perhaps £17

Returns from Coffee per acre.

Calculating the average price of a crop at £80 in London, the return per acre is approximately £12 per annum.

POSSIBILITIES AND ATTRACTIONS OF COFFEE GROWING IN KENYA.

From the foregoing paragraph it will be seen that coffee growing in Kenya may well be looked upon as remunerative.

Perhaps it is of as great or even greater importance to know what manner of life is that led by the planter.

To begin with the altitudes between which coffee grows best and the climatic conditions that it prefers are healthy to white people.

The life is one largely spent in the open air and although it is not advisable for the planter to indulge in regular manual labour, yet he has many opportunities of keeping his muscles hard and himself fit.

It depends—perhaps too much—on the man himself as to the amount of work that he has to do, but many conscientious men find ample to occupy them from 7 a.m. to 5 p.m.

A planter's evenings are largely free even though he elects to do his correspondence and books at that time.

The life is one that is eminently suited to the married man, for there is no duty that takes him away regularly from his home.

Rather is the danger the other way, and the general condition of a planter's life are apt to make him self-centred and self-indulgent, but the remedy is there, if every planter cares to interest himself in outside matters even if it is only in the matter of co-operation with his neighbours in the furtherance of their general welfare.

Kenya in general is a land both beautiful and healthy. For the Sportsman there is shooting and in the near future, it is hoped that there will be a considerable amount of excellent Trout Fishing.

The country is as yet too young and too sparsely settled to have developed an extensive social life, but everywhere nowadays, even in the remoter districts, are small Sports Clubs for tennis etc., being formed, and in the course of a very few years doubtless there will be enough social intercourse to satisfy the needs of any but confirmed townsmen.

Finally the quality of the coffee produced in Kenya has, in spite of bad cultivation and preparation, secured a name as being of very high grade, and so with further development and greater knowledge and care in selection of seed and in cultivation and preparation, it appears by no means impossible that future years may bring Kenya to the forefront as producing some of the very highest quality coffee in the World.

COFFEE FARMS.

To those wishing to purchase Coffee or other Estates we offer our eighteen years' experience.

ESTABLISHED IN 1903

We have compiled what is probably the widest selection of properties existing to-day, and this is at the disposal of prospective settlers.

Those requiring information on general subjects, conditions in Kenya Colony to-day etc., etc. Are cordially invited to write.

All enquiries are carefully and promptly dealt with

NEWLAND, TARLTON & CO., LTD.

Safari Dept.
Sadler Street,
NAIROBI.

Land Dept.
Sixth Avenue,
NAIROBI.

Tel. Add. "SAFARI, Nairobi."

INDEX.

A.

Advances on Crop 94
Agobiada, System of Pruning 72
Albizzia Moluccana 42
Albizzia Stipulata 43
Albizzia, Odoratissima. 43
Altitude, Effect of. 1
Analysis of Soil. Importance of. 3
Analysis of Soil, Method of Taking. 3
Antestia Lineaticollis. 54
Anthores Leuconotus 62
Apate Monacha. 62
Arsenate of Lead 59
Aspect, Most Suitable. 4
Asterolecanium Coffeae, see Pit-making Scale.

B.

Bagging, Directions for. 93
Bags, Picking 84
Bags, Weight of. 93
Ball Planting. 31
Banana Shields 35
Barbecues, Drying. 89
Baskets, Picking. 84
Bean Borer, see Coffee Berry Beetle
Beans as a Catch Crop. 35
Beating Out, Digging and. 16
Black Blight. 50, 60
Blossom, Estimation of. 69
Blue Mountain Coffee 1
Bluestone, see Bordeaux Mixture.
Bone Manure 81
Bordeaux Mixture. 32, 46, 53
Bordeaux Mixture, Experiments with. 48
Brokers, List of. 93
Brown Eye Spot. 50
Brown Scale, see Lecanium Hemisphericum.
Brushing with Soap Suds. 61
Buildings, Repairs to 75
Burning after Clearing. 14
Bush, Cutting 14

C.

Calcium Carbide, see Carbide Mixture.
Calpurnia Aurea 41
Capital, Amount of. 5
Capping, Method of. 37
Carbide Mixture. 46, 49
Catch Crops. 35

J MARCUS.

Government Road.

NAIROBI.

P. & O. Canton Disc Ploughs.

Coffee Pulpers, Hullers, etc., etc.

Culivators. All sizes.

Mealie Grinding Mills.

Bain Wagons, Stump Pullers.

Hessian. Gunnies.

Blasting Powder, Gelignite.

Dynamite, Detonators.

Rock, Coarse, Dairy & Table Salt.

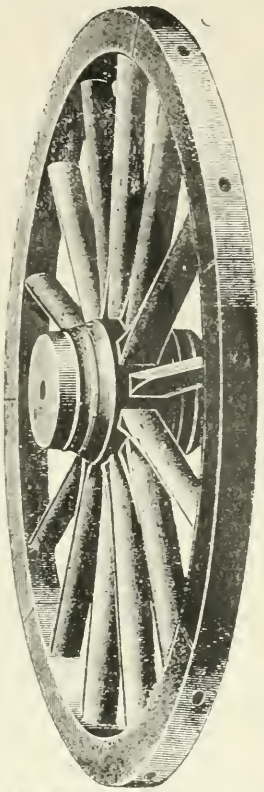
P.O. Box 14. **'Phone 65.**

Tels.: "**MARCUS.**"

Catch Pits. 36
Cedrella Toona. 43
Cemiostoma Coffeellum, see Leaf Miner Moth.
Centreing, Method of. 73
Cercospora Coffeicola, see Brown Eye Spot.
Chains, Lining. 18
Chalcid Fly. 54
Clearing with Squatters. 14
Clearing, Method and Advantages of Partial.
Climatic Conditions. 1
Climbing Cut Worm. 58
Coffea Robusta 1
Coffee, Figures of Costing of. 98
.. Species of. 1
.. Home of. 1
.. Hybrids. 1
.. Mountain Type of. 2
.. Wild. 1, 15
.. Soils suitable for. 2
Coffee Berry Beetle 62
Coffee Bug, see Antestia.
Coffee Growing, Attractions of. 99
Coffee Seed, Importance of. 22
Commerce in Coffee 94
Contour Trenches 36
Co-operation, Necessity for. 95
Copper Arsenate, see Paris Green.
Copper Sulphate, see Bordeaux Mixture.
Couch Grass. 16, 33, 70, 74
Crop, Advances on 94
Crop, Hypothecation of. 94
Crotalariae 36, 77
Croton Elliotanus, see Makinduri.
Cultivation. 33, 70
Cultivators, Ox-drawn 33
Cutting Bush or Forest 14
Cutting Pegs. 17
Cut-worm, (Plusia Orichalcea) 57
Cut-worm, (Prodenia Litura) 57
Cut-worm, Protection against. 34

D.

Dalbergia Latifolia. 43
Depth of Soil. 2
Diarthrothrips Coffeae, see Thrips.
Die-Back. 49
Digging and Beating out, Cost of
Dishudding. 37
Diseases, Notes on Fungous. 45
Distance of Planting. 17, 73
Draining, Necessity for. 17



HAWLEY & Co.

NAIROBI.

The oldest established **Cart and Wagon Builders of Kenya.**

We undertake to build you anything on wheels.

OUR MOTTO.

PRICE. QUALITY. ENDURANCE.

Two 1st prizes and Gold Medal for Carts and Wagons, at Nairobi Agricultural Shows.

Repairs promptly and neatly executed.

Motor Car Bodies, Safari, Closed Van and Cage types.
Material and Workmanship our speciality

P.O. Box 607.
Phones:—*Office* **439.**
„ *Works.* **264.**
Head Office. *Government Road.*
Works *Commercial Road.*

The Leader

OF BRITISH EAST AFRICA
UGANDA AND THE LAKES

KENYA'S LEADING NEWSPAPER

Weekly Edition

The Planters' Popular Organ. Published Every Saturday.

Daily Edition

The Capital's Most Watched News Journal.
Deliveries Daily to all Nairobi Suburbs before 7 a.m.

Send Your Subscription to
"THE LEADER" OFFICE,
P.O. Box 67. NAIROBI. Phone No. 115.

Draining, Description of. 17
Dryers, Mechanical. 90
Drying, Process of. 89
Dusting, Process of. 53
Dyrphia Usambica 62

E.

Erythrina Lithosperma 41
Estate Books, Necessity for. 66
Estate Books, Examples of. 67, 68
Estate, Example of Development of Small. 5
Estate, Example of Development of Large. 10
Estate Marks. 93
Estimation of Crop 69

F.

Factory, see Folded Plan. .. .. Back of Book.
Felling trees. 14
Fences, Repairs to. 74
Fencing, Value of. 34
Fermenting, Process of 87
Filling. 21
Filling, Cost of. 21
Firepaths. 34
Firepaths, Cleaning of. 75
Fish Manure. 81
Fly, see Leaf Miner Moth.
Forest, Cutting of. 14
Forks, Foot. 28
Forks, Light, pronged. 33
Four-stemmed Trees. 72
Framework for Planting Coffee Seedlings. 26
Fungous Diseases, General notes on. 45

G.

Cleaning. 85
Grading, Process of. 92
Grass, Couch 16,33,70,74
Green Dressings. 35, 77
Grevillea Robusta. 34, 43
Grevillea Robusta, Leaves of. 27
Ground Nuts as a Catch Crop. 35
Guano. 83

H.

Handling. 37, 73
Harbas Mixture. 46, 49
Harrowing, Ploughing and. 16

HAVE YOUR COFFEE CURED AT

MONCKTON'S
Coffee Curing Works

SITUATED AT

Kahawa Station, Thika Tramway.

WORKED ON CO-OPERATIVE LINES

Under experienced European Supervision.

For particulars apply to:—

C. C. MONCKTON & Co.

P.O. Box No. 310. NAIROBI.

Ship your Coffee to

T. H. ALLAN & CO.

17, Gracechurch Street, London E.C.

The oldest established Firm of Coffee Merchants on the London and Continental Markets.

ADVANCES MADE AGAINST COFFEE

As soon as delivered on Rail, in Godown or at Curing Works, or during picking by arrangement.

INSURANCE.

Shipments to Messrs T. H. Allan & Co. are covered AGAINST ALL RISKS from time of picking.

For full particulars apply to their Agents:—

C. C. MONCKTON & CO.

Telegrams;	P. O. Box 310	Telephone No. 421.
"Monckton."	Nairobi.	Nairobi.

Hemilea Vastatrix, see Leaf Disease.
Holing, Pitting or. 21
Home of Coffee. 1
Hullers, see Peelers.
Hulling, see Peeling.
Humus. 2, 14

I.

Indian Rosewood, see Dalbergia Latifolia.
Indigoferae. 36
Insect Pests, General Notes on. 52
Inspectors of Coffee, Necessity for 97

J.

Jachson's Hybrid Coffee 1

K.

Jackson's Hybrid Coffee. 1

L.

Labour-saving Devices, Necessity for. 96
Labour, Supply of. 2
Land, Selection of. 4
Lead, Arsenate of. 59
Leaf Disease. .. .. 46 — 49
Leaf Miner Moth. 58
Lecanium Africanum. 60
Lecanium Hemisphericum 61
Lecanium Viride, see L. Africanum.
Legislation, Importance of 97
Leming's System of Pruning 73
Light Coffee, see M'buni.
Lime. 51, 53, 54, 76, 81, 82
Lime for Nurseries. 24, 27
Lime for Use in Bordeaux Mixture, see Bordeaux Mixture.
Lining-out, General Instructions in. 18
Lining-out, Systems of. 19, 20

M.

Machaerium Tipa. 41
Magnesia. 82
Mahutu or Mahuru. 41
Maize as a Catch Crop. 35
Makinduri. 41
Manures, Application of Bulky. 80
Manures, Application of Non-Bulky. 82
Manures, Bulk. 78
Manures, Chemical. 81
Manures, Green. 77
Manures, Organic. 81
Manuring, Necessity for. 77
Markets for Coffee. 95
Marks, Estate. 93
Matama as a Catch Crop. 35

U. S. TYRES.

A range of Tyres from which you can choose to meet your particular needs.

ROYAL CORD.—Both resilient and Flexible. Designed for the motorist who demands remarkable easy riding qualities and extra long mileages. A cord tyre of extraordinary toughness and strength.

NOBBY:—For the motorist who does not consider first cost, but rather final cost based on service. A most efficient anti-skid tyre for all kinds of roads. Heavy of construction, quality of rubber and fabric, and renowned for long mileages over very rough country. Commonly known as *the aristocrats of the road.*

CHAIN:—So designed to give grip and suction abilities which have made it famous. A full valued tyre which is unquestionably the best moderate-priced anti-skid in the country.

USCO Tyres are made to fill a popular need for a low priced serviceable tyre They are so constructed as to have most rubber where there is most wear—on the tread.

Ask for U. S. TYRES.

Stocked by most Garages.

Agents :

THE McMILLAN ESTATES.

'Phone 165. 6th Avenue, NAIROBI. Box 213.

Mats, Drying. 90
M'buni. 85
Mealy Bug 61
Mealy Scale, see Mealy Bug.
Mocha Coffee 1
Mountain Type of Coffee 2
Mugumu 43
Mukuyu 42
Mulalachi 43
Mulching 32, 78
Mwangwa. 41

N.

Nicotine, Infusion of. 61
Nicotine Sulphate, Dusting with. 53
Number of Trees per Acre, Table of. 20
Nurseries, Care of. 27
Nursery, Choice of Site of. 24
Nyassa Variety of Coffee. 1

P.

Parallel System of Lining-out. 20
Parasa Vivida, see Stinging Caterpillar.
Paris Green. 35, 57
Parthogenesis in Scale Insects. 60
Paths, Necessity for. 20
Peelers. 91
Peeling, Process of. 91
Pegs, Cutting. 17
Pepper Tree, see Schinus Molle.
Permanent Beds for Coffee Plants. 25
Pest Act. 97
Pests, General Notes on Insect. 52
Phoma, see Die-Back.
Phosphoric Acid. 81
Physical Conditions. 2
Picking, Description of. 84
Pithecolobium Saman. 43
Pit-Making Scale. 61
Pitting or Holing. 21
Pitting or Holing, Cost of. 21
Planting, Ball. 31
Planting, Distance of. 17, 73
Planting Framework. 25
Planting Out, Age for. 27
Planting Out, Description of. 32
Plants, No. of to 1 lb. of Seed. 32
Plants, Permanent Coffee. 18
Plants, Protection of. 44
Plants, Rejection of. 31
Plants, Shading of. 32
Plants, Temporary Coffee. 18

SIMPSON & WHITELAW,

Limited.

NAIROBI.

Keep your Coffee clean and healthy by using only first quality spraying materials applied with best and most economical spraying machines.

Four Oaks Spraying Machines.
Copper Sulphate.
Lime.
Calcium Carbide.
Washing Soda.
Resin.
Arsenate of Lead.
Paris Green.
Harbas Oil.

Coffee Pruning Knives.
Secateurs.

Suppliers of the Famous French Mission Coffee Seed.

Ploughing and Harrowing, Cost of. 16
Plusia Orischalcea 67
Polishing, Process of. 91
Poonac, (Manure) 81
Potash 82
Potash Salts. 81
Prodenia Litura 34, 57
Pruning, Root—. .. .. 28—30
Pruning, Shade. 74
Pruning, Systems of .. .. 70—73
Pseudococcus Adonidum, see Mealy Bug.
Pulp Compost, Making of 78
Pulpers (and see advertisement section). 86
Pulping 86
Pulvinaria Psidii. 61

Q.

Quincunxing, System of Lining-out 20

R.

Rainfall 2
Record Books, Value of. 66
Record Books, Example of. 67, 68
Renovation of Old Coffee, Description of 75
Resin 61
Roads, Necessity for. 20
Roads, Repairs to. 75
Root Disease, see Stump Rot.
Root Pruning, Examples of. .. .. 28—30

S.

Saltpetre as ingredient for spraying 61
Saltpetre, Method of Clearing Stumps With 15
Scale Insects .. .. 60—62
Schinus Molle 43
Seed Beds 24
Seed, Choice of. 22
Seed, Germination of. 25
Seed, Preparation of. 23
Seed, Sowing of. 25
Seedlings, Transplanting of. 26
Selection of Land 4
Sesbania. 36, 41
Shade, Overhead for Nurseries. 26
Shade, Pruning of. 74
Shade Trees, Qualities Necessary for Permanent. 42
" " Qualities Necessary for Temporary. 40
" " Species of Permanent. 42
" " Species of Temporary. 41
Shading, Description and Value of. 39
Shading, Plan of. 44
Shipment. 93
Silver Oak, see Grevillea Robusta.
Single-stemmed Tree, System of Pruning the. 70

For **Proved Varieties** of **Grafted Deciduous Fruit-trees,** guaranteed to grow and fruit in Kenya Colony. *Write to:*

GEORGE STUART WATT,

Donyo-Sabuk Orchards and Nurseries.

P. O. "Chaniabridge."

For his descriptive Catalogue and Price List also illustrated pamphlet on "Deciduous Fruit-growing in Kenya Colony" sent post free on application.

MENGO PLANTERS, LTD.

Kampala, Uganda.

ESTATE OWNERS & MERCHANTS.

Every requirement for the Planter, Farmer, Builder, Carpenter, Mason, Engineer, etc., Having run our own Plantations for Coffee and Rubber for the past twelve years we are in a position to know the best materials and tools and stock same in our extensive hardware department. Drapery Goods of every description.

Ladies and Gentlemen's tailoring underlaken in all branches Furniture made to order from any design in our own shops.

Plantations in Uganda managed and advice freely given on Land, etc.

Mengo Planters Limited, Kampala, Uganda,

Soap, as ingredient in spraying mixture. 61
Soap Solution. 53
Soil, Analysis of. 3
Soil, Depth of. 2
Soil, Method of Taking Analysis of 3
Soil, Working the. 16
Soils, Varieties Suitable. 2
Sooty Mould, see Black Blight.
Species of Coffee 1
Sport. 99
Spraying, Method of. 46
Squaring System of Lining-out 19
Squatters, Clearing by means of. 14
Squatters' Ordinance. 14
Standard Measure, Necessity for. 90
Stephanoderes Hampei, see Coffee Berry Beetle.
Stinging Caterpillar. 52, 58
Stumping Jack. 15
Stumping Jack, Co-operation in use of 15
Stump Rot. 50
Sulphuric Acid, Method of Clearing Stumps with. 15
Supplying up Misses. 74

T.

Table of Number of Trees per Acre. 29
Terminaliae. 43
Three-stemmed Trees. 72
Thrips. .. .. 52—54
Topping, Method of. 37
Transport, Facilities for. 3
Trays, Drying 90
Trenches, Contour. 36
Trenches, Repairs to. 75
Trenching, Value of. 34
Triangular System of Lining-out. 20
Two-stemmed Trees. 72

V.

Vats, Fermenting and Washing, (see Plan). .. .. 87—89

W.

Wash, Prevention of. 36
Washing, Process of. 88
Water, Storage of. 86
Weeding. 70
Wembi as a Catch Crop 35
Wild Coffee 1
Windbreaks, Necessity for. 34
Wind-Wrung Plants. 32
Working the Soil. 16

Y.

Yield of Coffee, Figures of 98

UCSB LIBRARY
X-51931

Nairobi's Departmental Stores.

P.O. Box 255.

Tel. Nos. 126, 477.

INCORPORATING:

THE CIVIL SERVICE CO-OPERATIVE SOCIETY, LTD.

We Can Supply Your Every Need

WITH

The Best at Lowest Prices.

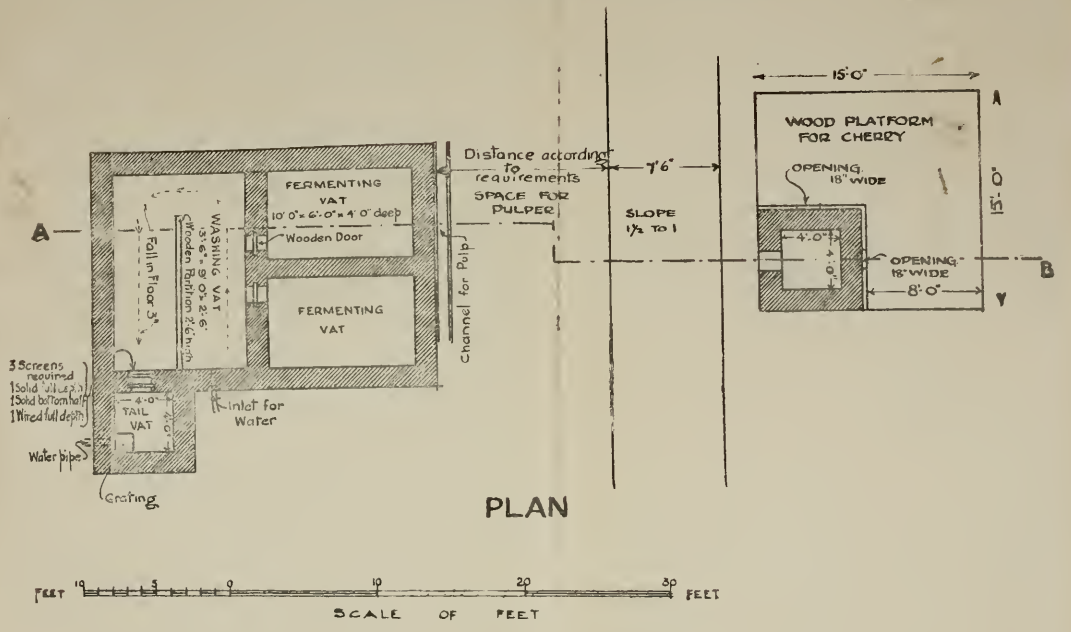
Grocery and Provisions.
Bread and Confectionery.
Butchery.
Greengrocery.
Dairy Produce.
Wines and Spirits.
Tobacco and Cigarettes.
Toilet Requisites.
Sports Goods.
Guns and Ammunition.
Furniture.
Basket Furniture.
Carpets, Rugs, Mats.

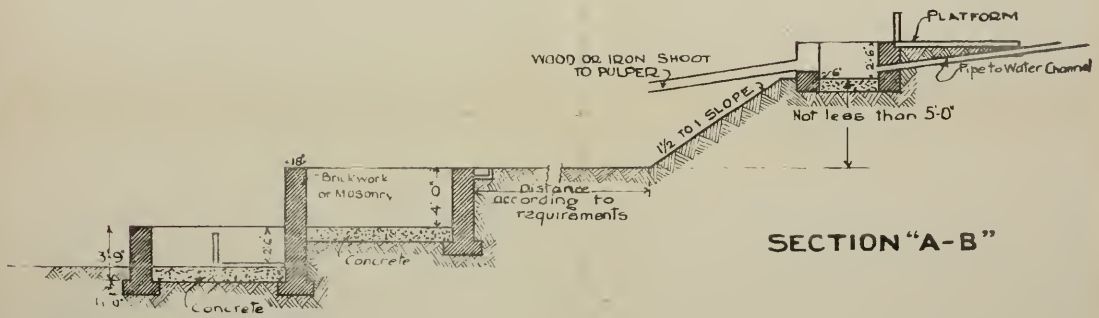
Ladies Outfitting.
Gents ,,
Children's ,,
Boots and Shoes.
Haberdashery.
Tailoring.
Furnishing, Drapery.
Hardware.
China and Glassware.
Dairy Requisites.
Garden Requisites.
Gramophones and Records.
Perambulators. Go-Cars.

THE STORE THAT SATISFIES.

Branches: MOMBASA — NAKURU — ELDORET.

PLAN OF COFFEE FACTORY.





"PRACTICAL COFFEE PLANTING."

UC SOUTHERN REGIONAL LIBRARY FACILITY
A 000 611 535 6